LIGHT, JULY 15, 1937 FIRST AERO WEEKLY IN THE WORLD

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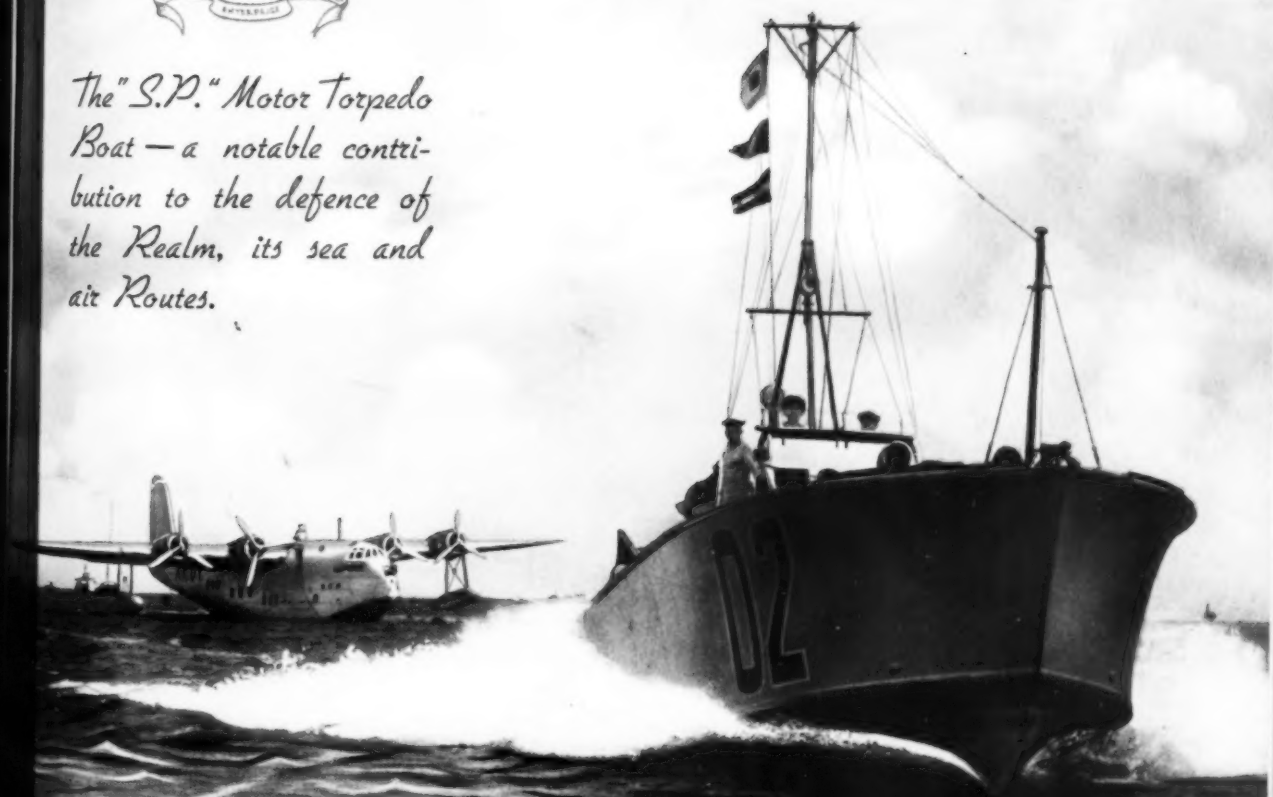

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The AIRCRAFT ENGINEER AND AIRSHIPS

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The Beginning of Things

TWO great English-speaking nations rejoice in the success of the first transatlantic survey flights in opposite directions between Ireland and Newfoundland. The Short boat of Imperial Airways and the Sikorsky S.42B of Pan-American Airways made history when, as recorded last week, they covered the 2,000 miles of ocean safely and to schedule. Everything went smoothly—almost too smoothly, for it would be unwise to conclude from this success that the operation of the route to a fixed time-table is practicable at once. An immense amount of testing is still needed before we can know what percentage of scheduled flights it is possible to count upon in the course of a summer. This can only be determined by running the experimental flights over a very considerable period.

But these problems need not interfere with our pleasure and gratification at the good beginning which has been made, and Imperial Airways and Pan-American are to be heartily congratulated on their first joint effort. The start was, it is true, made under fairly favourable circumstances, but the success was in no way to be ascribed to luck. Months of painstaking preparations had preceded the first flights, and the deceptive ease with which they were made should not be permitted to obscure full recognition of the good ground work done beforehand, without which the flights could not have been attempted, let alone completed so punctually.

It is too early to attempt to draw lessons from the first crossing of the Atlantic by commercial aircraft under operating conditions, but in conversation with the crew of the Sikorsky at the private dinner given to them at Claridges last Thursday by Imperial Airways it was possible to ascertain certain outstanding facts. For instance, navigation was not found unduly difficult, in spite of the fact that the route is very nearly a straight line between the two wireless stations, and that, therefore, an error of one degree might mean a great error in distance along the route. This error is not always very serious; so long as the machine is on the route a difference of several miles in longitude is of no great importance unless the machine is near one or other of the terminals. Nevertheless, one may visualise conditions when it would be very important to know the exact longitude, and for this to be determined by direction-finding a third station well off to one side may become desirable. Southern Greenland appears to be the most suitable location for such a transmitter, as it is so situated in relation to the route that good "fixes" from it should be possible at any stage.

Wireless is likely to play a very large part in the success of the transatlantic air route, and practical experience is needed before all the problems can be settled. The effects of frost on the "earth" of the transmitting station have to be ascertained. Another difficulty may also be caused by frost: The antenna of the short-wave station must be strictly vertical, and when severe frosts occur the foundations may be affected and may tilt the aerial, which would then give wrong direction indications. Ice may be found to form not only on the aircraft themselves, where it would constitute a danger, but on their aerials, where it would spoil reception.

Stellar Navigation

It seems fairly obvious that, at some time or other, due to climatic conditions, radio will fail, at least temporarily, and for that emergency it will be necessary to carry alternative navigational equipment. Fortunately the bubble sextant provides such an alternative, and when it is possible to get right above the cloud layers this instrument will give results accurate to within a very few miles. This would suffice along the route, but at the terminals a more exact knowledge of position is obviously necessary. It may even be that it will be found essential, to ensure operational regularity, to arrange for blind-landing facilities to be available at the terminals. The actual touch-down should be rather easier than on land, since there are no obstacles to clear in the immediate vicinity, but the question of beacons might present difficulties, unless they could be carried on buoys or similar floating bodies.

The meteorologists on both sides appear to have done their work well. They foretold the clouds and the rain, which appeared exactly when and where promised, and when the experience of the aircraft crews has been added to that of the meteorologists, the cumulative knowledge should in course of time suffice for deciding when a flight is or is not advisable. That will suffice for a start, but before regular mail-carrying services can be undertaken it will also be essential to compile data of such things as wind velocities at different heights in order that the machines may take advantage of them. Generally, it will probably be found that it will pay to fly low on the westward journey, weather conditions permitting, and high on the eastward in order to take advantage of the following wind in one case and minimise its effects in the other.

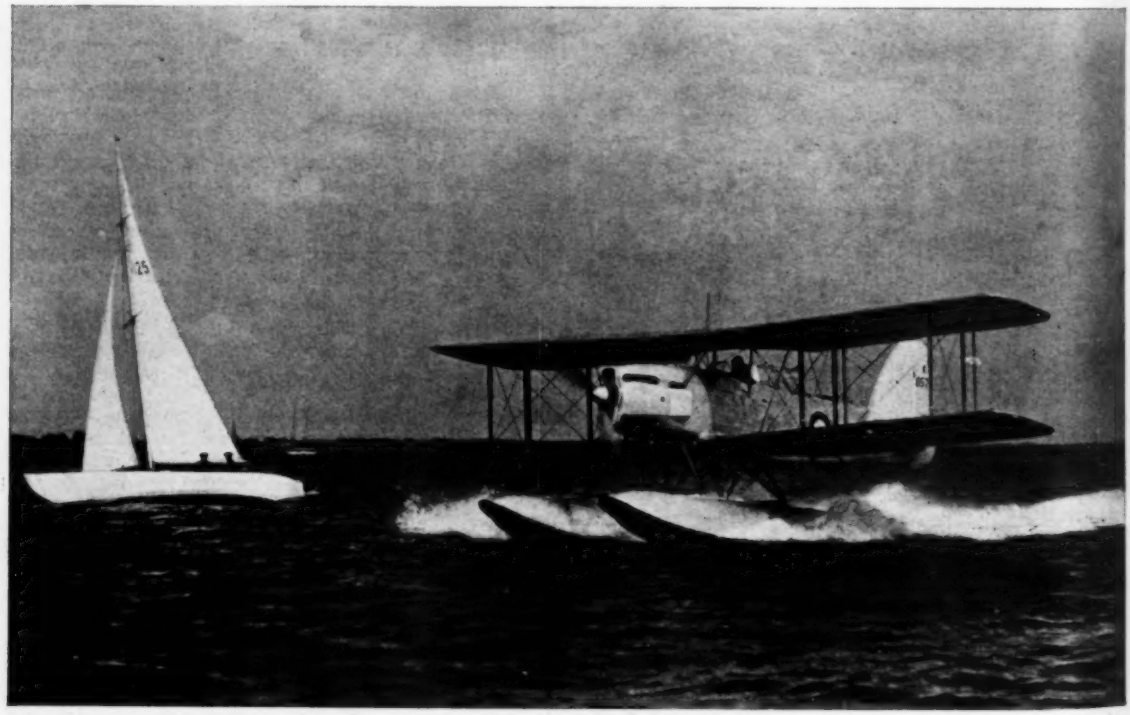
The aircraft themselves and their engines can now be said to have attained to a state of reliability when little is to be feared on that score; with the careful maintenance which they can be counted upon to receive in the hands of the Imperial and Pan-American engineers, forced "landings" can almost be ruled out entirely, at any rate of the type caused by mechanical failure. The only other cause likely to occur is fuel shortage. This would only arise from one of two sources, or from a combination of the two: Unexpected and unsuspected head winds and poor course-keeping. As meteorological knowledge grows, the former is very unlikely. The latter is a matter of navigation, and with proper wireless facilities, using stellar navigation as an alternative and a check, a deviation from the planned course great enough to cause petrol shortage is a remote possibility.

So much for the technical aspect. Mechanical ability to carry out the Atlantic crossing without mishap is, although the first and most important step, not an end in itself. To be of any practical use the machines must be able to carry a pay-load sufficient to make the whole undertaking worth while. One may say with justice that the technical problems are in a fair way to being solved, but the same cannot yet be said of the economic, and to justify the energy and money being expended on the first experiments it is well to look ahead and to examine the prospects.

The Question of Pay-load

The aircraft which are being used on the experimental flights have little chance of proving able to carry a sufficient pay-load. It is thought that much larger machines of the same general type might be able to show a profit, but that still remains to be proved. Such aircraft are being built on both sides of the Atlantic. In the meantime work is nearing completion on the Short-Mayo composite aircraft, in which the upper component is a small but very heavily loaded seaplane that is carried to its operating height by the "mother" boat. The upper component then proceeds on its way and the lower returns to its base.

This small machine should be able to carry a fairly reasonable pay-load, although doubtless better results could have been obtained with a landplane with retractable undercarriage. Certain technicians foresee the possibility of combining cruising speeds of 300 m.p.h. with long range and a fairly large pay-load. Should that view prove correct, the pioneering work with more orthodox aircraft will still prove invaluable, for it will have provided experience for crews and data for the engineers.



FOR LIGHT RECONNAISSANCE: The first of a batch of the new Fairey Sea Foxes, which have the Napier Rapier VI—the 370 h.p. (at 4,750 ft.) sixteen-cylinder "small sister" of the H-type Dagger. The Sea Fox is specially designed for arduous catapult work, and to that end is liberally furnished with aids for (and defence against) deck crews. (*Flight* photograph.)

The Outlook

A Running Commentary on Air Topics

Salaried Sluggishness

FOR a number of years now transport pilots have usually been paid a fixed retainer with a bonus for flying hours. So long as the different machines in a company's fleet—or those of competing firms—had much the same cruising speeds all was well, but nowadays there are a number of complications.

The pilot who is fortunate or unfortunate enough to be handling fast aeroplanes on his regular runs is automatically paid less for work which is usually more difficult and responsible than that of his fellow pilots who are in charge of slower machines. An obvious solution is to adjust the flying pay so that it is based on mileage rather than on hourage.

Meanwhile, it is possible that operators are losing quite a lot of money, both in fuel and salaries, because the average pilot does not worry too much about accurate navigation. Why should he? If he takes five minutes more on the A to B run—because he hangs carelessly on to an initial compass course until radio bearings are eventually collected from B—his salary is so much greater. The fact that no complaints are ever made on this score says a good deal for the natural honesty and professional pride of our transport pilots.

Changes, nevertheless, will have to be made in the salary system. Probably they will take the form of a mileage arrangement with a purely nominal "fine" system for really unreasonable delays. Happily enough, pilots do not complain publicly about the inequities of the present arrangements; perhaps we shall hear more about it through the new Association.

The Human Engine

VERY provocative is the article by Mr. Granville Bradshaw which we publish this week. His ingenious combination of hand-and-foot operation may, and probably does, add something to the power which a man can produce; this should be possible by permitting the limbs to work in the most effective and efficient way. But when it comes to calculating the horse-power needed to change the sloping path of a glider into a horizontal flight path, it is to be feared that Mr. Bradshaw suffers from an excess of optimism.

Taking as his starting point a glider with an L/D ratio of 30: 1, Mr. Bradshaw comes to the conclusion that something like one-fifth of a horse-power will suffice to keep man and machine, weighing together 230 lb., flying horizontally. If that were so, flight by human power would have arrived long ago, even with the airscrew propulsion which he casts aside. Unfortunately, the picture is not quite so rosy.

In order to achieve a flying speed as low as 8 m.p.h., the wing loading would have to be a fraction of a pound and the wing span would probably be as great as that of the Empire flying boats! Such a glider could certainly not be built for a loaded weight of 230 lb. It is much more likely that the weight would be 300 lb. and the gliding angle 1 in 20. Even that would be an achievement of no mean order. If those figures are accepted, and a speed of 30 m.p.h. instead of 8 m.p.h. assumed, the power required for level flight would be nearly 1¼ h.p. It seems unlikely that a speed of much less than 30 m.p.h. could be expected, as the low wing loading would mean a large and fragile machine.

Mr Bradshaw estimates that in the University Boat Race the men develop more than 2 h.p. each for the duration of the race. Professor A. V. Hill, on the other hand, has stated that an athlete running uphill can probably exert about 1½ h.p., and that a sprinter running at top speed for 20 seconds can probably develop just over 2½ h.p., but would be exhausted and unfit for further effort for 20 minutes. Towing tests on a boat with crew aboard have indicated that the average power output per man is about one-half horse-power for 20 minutes.

This and more information on the subject is included in the note by Mr. Townend in the July issue of the R.Ae.S. *Journal*, to which we referred last week.

Flapping Flight

ALTHOUGH Mr. Bradshaw seems to have "come unstuck" on the questions of glider weights, speeds and the power which a man can develop, he appears to be in good company when it comes to his idea of using a form of flapping wing or rising and falling weight to imitate bird flight. Townend calls attention to the so-called "Katzmayr Effect" and to Cowley's R. & M. Note on this phenomenon. He comes to the conclusion that if the "Katzmayr Effect" is inverted by having the air-stream steady and the wing capable of both torsional and flexural oscillation, a very efficient aircraft might result. It seems to be largely a question of designing the wings to have a natural period of oscillation which would suit the natural speed of 'rowing" which the human power plant would adopt.

That a certain amount of energy can be extracted from a wind which is not uniform is agreed. Cowley, however, found that it was important that the wind "waves" should be long compared with the wing chord. This fact may have something to do with the apparent ease with which birds fly.

It is to be hoped not only that Mr. Bradshaw will continue his interesting experiment, but that Mr. Townend's final advice in the note referred to will be heeded. This reads as follows: "Even if the structural difficulties should appear great, it would seem to be worth while to know whether it is fundamentally possible to transfer the necessary power by the mechanism in question without using the large amplitudes of oscillation generally associated with the usual proposals of flapping flight." Mr. Townend's suggestion is for a mathematical examination along lines similar to those involved in the study of flutter.

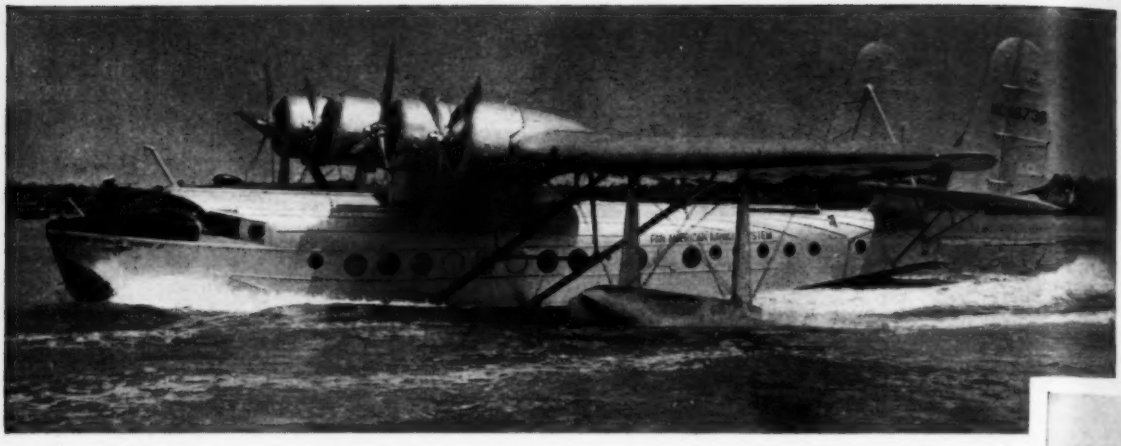
Aeroplane Noises

THERE has been some discussion in the papers lately about the noise made by aeroplanes flying over Oxford, and the disturbing effects it has upon serious study.

It is, however, interesting to note that a Fellow of All Souls' College has written to a contemporary to say that, to his surprise, he finds himself getting accustomed to the noise, and thinking it less troublesome than the noises of a railway station.

Nevertheless, *Flight* does not take the view that no effort should be made to reduce aircraft noise. On the contrary, everything possible should be done to minimise its effects, not merely out of consideration for people on the ground but also for strategical reasons. A bomber flying silently at 20,000ft. would be extremely hard to detect.

DIARY OF FORTHCOMING EVENTS—PAGE 74.



"Bradshaw" Crossings by Imperial Airways and Pan-American Airways Boats : The Story of the Historic Experimental Flights : Interesting Features of the Sikorsky S.42B Revealed on Inspection

ATLANTIC ROUTINE

AT 11 a.m. (B.S.T.) on Tuesday, July 6, *Caledonia* put down at Botwood, Newfoundland, thirteen minutes after the Pan-American Airways' Sikorsky S.42B had touched the water off Foynes. Each had travelled the 1,900-odd miles across the Atlantic, their skippers treating the affair as one of routine interest only. The fact that the eyes of the world were upon them provided, apparently, the only real cause for nervousness.

In last week's issue of *Flight* there appeared an article explaining the major navigation problems involved in such a crossing, outlining the general Atlantic position and briefly stating the facts of success. Later in this article is a description of the successful Pan-American boat, with some comments on the navigational methods employed by her crew.

Caledonia, in her general design and primary structure, is identical with the Short boats of the Empire class. A detailed description of the class appeared in *Flight* of October 29, 1936, but it may be of interest to recall some outstanding features. Each machine is an all-metal four-engined cantilever monoplane, with a two-stepped hull. Stability on the water is obtained by two outboard floats. Each Bristol Pegasus Xc engine is rated at 740 b.h.p. at 3,500ft., a total of 2,960 h.p. These units each give 910 b.h.p. for take-off, with the De Havilland v.p. airscrew turning at 2,475 r.p.m.

An interesting point is that the Pegasus Xc was the first unit operating on 87-octane fuel to go into service with a British air line.

The Short boats are of 114ft. span and 88ft. length. The wing area is 1,500 sq. ft.

Caledonia differs from her sisters mainly by reason of the fact that luxurious cabin equipment has been omitted and the interior is of a strictly utilitarian character. A greater gross weight has been permitted, 45,000 lb , compared with the 40,500 lb. of the other boats. Extra tanks have been installed in the wings, thereby increasing the fuel and oil load from 4,960 lb. to 18,750 lb. With this fuel and oil load the *Caledonia* has a range of 2,500 miles against a head wind of 40 m.p.h. when cruising at an airspeed of 160 m.p.h.

To show how efficient, from an engineering point of view, is the structure of the *Caledonia*, it may be pointed out that the machine weighs, bare but with the extra fuel and oil tanks, 23,200 lb. As the gross weight is 45,000 lb. the ratio of gross to tare weight is 1.94, which is merely another way of saying that the machine carries as disposable load 94 per cent. of its own bare weight. This is an unusually good ratio, especially for such a large aircraft.

The special equipment of the machine accounts for a weight of 1,450 lb., and this leaves 1,600 lb. for crew and pay load. With a crew of four there is thus available

approximately 800 lb. for pay load, although on the first experimental flights none was, of course, carried.

As the distance from Ireland to Newfoundland is 2,000 miles, there is a very large margin of fuel in hand, so that even if the average head wind should exceed the 40 m.p.h. used in the calculations, the machine would still be able to reach its destination without fear of fuel shortage. A list of the proprietary components and equipment which contributed towards the success of the initial Atlantic flight appears at the end of this article.

The trips across the Atlantic, both for *Caledonia* and *Clipper III*, were uneventful and went exactly according to plan. Wireless communication was practically continuous, the Foynes medium-wave set, which was expected to fade out at about 400 miles, remaining useful up to 900 miles, and all weather predictions proved correct.

Caledonia started her take-off from the River Shannon at Foynes at 7.57 p.m., shortly after hearing from Capt. Gray, of the Sikorsky, at Botwood, the words "We are coming." Capt. Wilcockson replied to this, "So are we," and then the large crowd saw *Caledonia* lift off her seven tons of petrol in thirty-five seconds. Frequent reports came in from her at 25 and 55 minutes past each hour. These were, briefly, as follows:—

9.15 p.m. (B.S.T.) ..	Good progress.
10.35 ,, ,, ..	Rain patches, clouds at 1,000 ft. Westerly wind 20–25 miles per hour.
10.52 ,, ,, ..	Now 350 miles out.
12.10 a.m. (B.S.T.) ..	Wireless contact with Cunard White Star Liner *Alaunia*.
12.30 ,, ,, ..	500 miles out; in darkness.
4.6 ,, ,, ..	Passed *Clipper III* approximately 60 miles apart, *Caledonia* being 1,043 miles out, *Clipper* 952 miles. *Caledonia* reported to Capt. Gray, "Cloud 300–2,000 ft., rain patches from Foynes to Long. 35 west, wind 22–25 miles per hour."
7.0 ,, ,, ..	Message to Air Ministry. *Caledonia* 1,300 miles out.
10.20 ,, ,, ..	Passed over Newfoundland coast.
11.0 ,, ,, ..	Landed at Botwood, after cruising round in the mist.

The crew of *Caledonia* were welcomed by the Governor-General of Newfoundland, Vice-Admiral Sir Humphrey Walwyn.

The total time taken by *Caledonia* was 15 hr. 3 min., and the distance covered was 1,993 miles, giving an average speed of 132 m.p.h. The Short boat flew the first half of the journey at about 1,500ft. and then rose to 5,000ft. on reaching clear weather. She naturally flew fairly low because of the adverse wind.

The Pan-American Sikorsky was also in constant con-

On the left is a photograph of the Sikorsky S.42B taken at Southampton after the crossing, and below it the commander, Captain Harold E. Gray, is seen being congratulated by the Mayor of Southampton, Ald. Chick; on the right of the group is Lt. Col. Sir Francis Shelmerdine, Director General of Civil Aviation; left is Mr. Hubert Scott-Paine, whose British Power Boats are handmaidens to Imperial Airways flying boats.
In the view directly below, the Sikorsky is seen from under the wing of an Empire flying boat, *Courtier*.

Caledonia and (above) Mr. de Valera, at Foynes, bidding farewell to three members of her crew: Capt. Wilcockson (left), First Officer Bowes and W/T Operator Hobbs.

tact by wireless from the moment she left Botwood at 10.12 on what her skipper called "a pleasant joy-ride." The more important reports from Capt. Gray were:—

10.30 p.m. (B.S.T.)	..	180 miles out.
12.0 „ „	..	Met first fog; position 50.27 N., 47.35 W.
4.6 a.m. (B.S.T.)	..	Passed *Caledonia* 952 miles out.
8.30 „ „	..	400 miles from Foynes.
10.47 „ „	..	Landed at Foynes.

The crossing took 12 hr. 34 min. in the air. *Clipper III's* average height was 10,000ft., and the distance covered on a great circle course some 30 miles shorter than *Caledonia's*, whose skipper flew, as explained in last week's issue, on a track approximating to a rhumb line in order to simplify the navigation. *Clipper III's* average was 156 m.p.h., and her crew were: Capt. H. E. Gray (Commander), W. S. Delima (First Officer), W. M. Masland (Second Officer), C. D. Wright (Engineer Officer), E. W. Smith (Assistant Engineer), T. J. Roberts (Radio Operator), and W. T. Thaler (Steward). At Foynes they were welcomed by Mr. de Valera himself.

Each of the boats used about two-thirds of the fuel taken aboard. *Caledonia*, for instance, took off with 2,320 gallons and used about 1,700 of them.

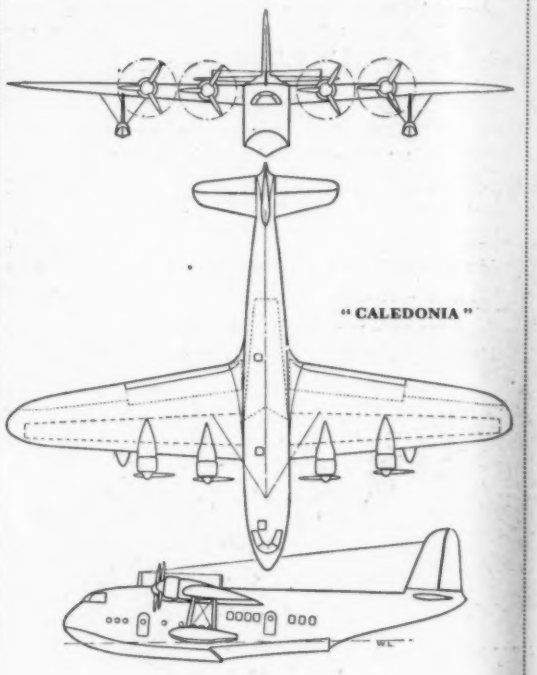
Sikorsky at Southampton

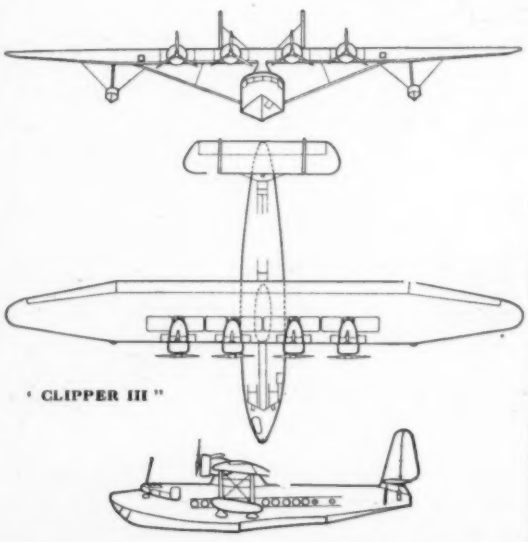
Two days later, on July 8, the Pan-American boat flew on from Foynes to Hythe, Southampton, where she was hauled up on the slipway in order that her engines and auxiliaries might be serviced. Her crew travelled up to London and were entertained at a private dinner. On the same day *Caledonia* was taken on a rather more ambitious jump—from Botwood to Montreal (886 miles), where Capt. Wilcockson put her down on the St. Lawrence at Boucherville.

The *Caledonia* arrived at New York from Montreal last Friday, July 9, and flew low over the sky-scrapers before alighting at the base in Long Island Sound. Her captain and crew were welcomed by the British Consul-General in New York, Sir Gerald Campbell; the Air Attaché to the British Embassy at Washington, Group Capt. T. E. B. Howe; the President of Pan-American Airways Mr. Juan Trippe; and officials of the United States Government.

The *Caledonians* spent last week-end in New York—incidentally in a heat wave—and were due to start their return journey to Montreal on Monday, with a view to leaving for the return journey to Ireland to-day, Thursday.

In London, Lord Swinton, Secretary of State for Air, received Capt. Gray, Commander of the Sikorsky.





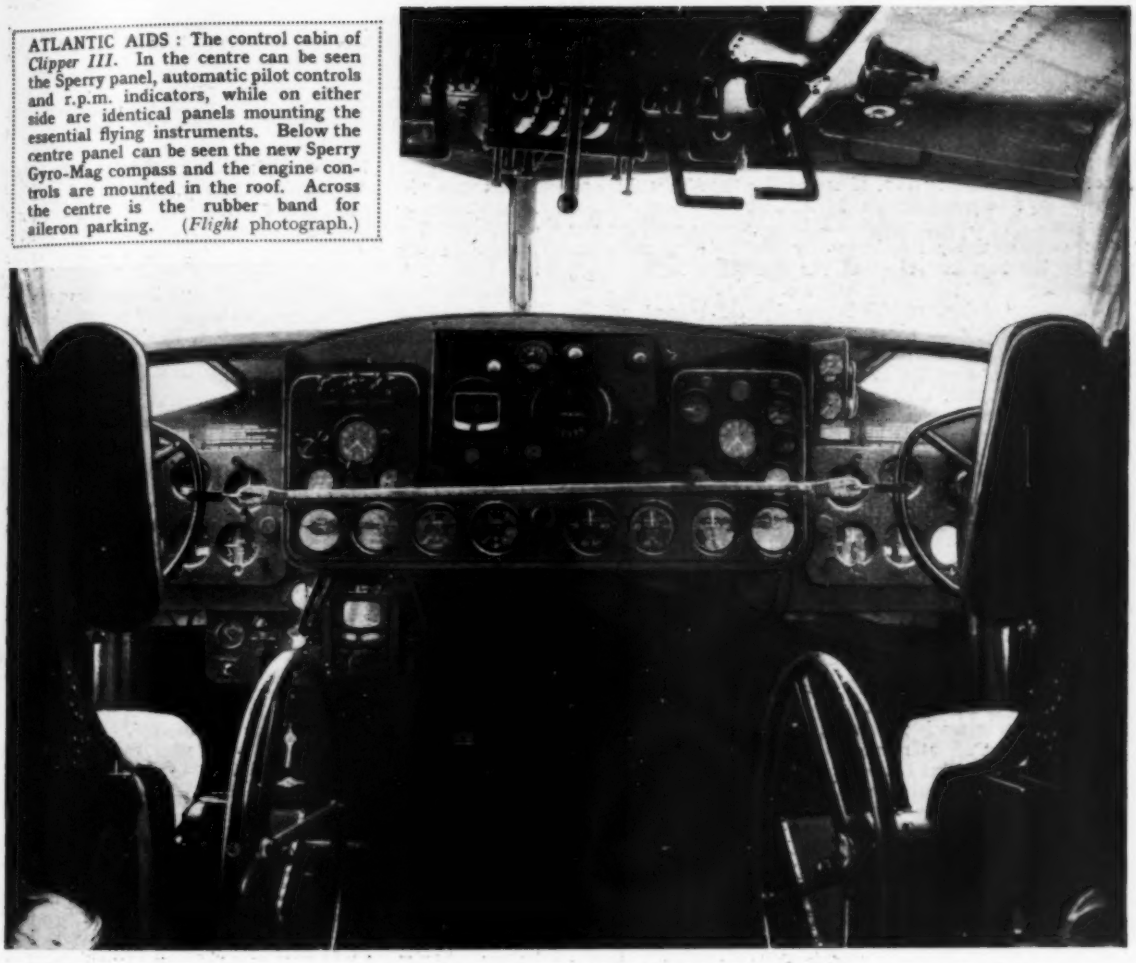
THE TWO BOATS
COMPARATIVE DATA

Dimensions.	Sikorsky S-42-B (long range).	Short Empire Boat (long range).
Span	118 ft. 2 in.	114 ft.
Length	68 ft.	88 ft.
Height	21 ft. 5 in.	31 ft. 9¼ in.
Wing area	1,340 sq. ft.	1,500 sq. ft.
Wing loading	33.9 lb./sq. ft.	27 lb./sq. ft.
Weight, empty	24 000 lb.	24,650 lb.
Fuel load (87 octane)	19,000 lb. (approx.)	18,750 lb. (2,320 gal.)
Payload (crew and mail)	1,600 lb. (approx.)	1,600 lb.
All up weight	45,500 lb.	40,500 lb.
Performance.		
Maximum speed	188 m.p.h. at 7,000 ft.	200 m.p.h. at 5,500 ft.
Cruising speed	163 m.p.h.	165 m.p.h.
Landing speed	65 m.p.h.	68 m.p.h.
Ceiling	15,500 ft. (Service)	20,000 ft. (absolute)
Cruising range	3,500 miles.	3,100 miles (at 165 m.p.h.)
Rate of climb	800 ft./min.	950 ft./min.
Engines. (9-cylinder radials.)	**Four Pratt & Whitney Hornets.**	**Four Bristol Pegasus Xc.s.**
Capacity	27.7 litres.	28.7 litres.
Normal output	750 h.p. (total 3,000 h.p.)	740 h.p. (total 2,960 h.p.)
Normal R.P.M.	2,250 r.p.m.	2,250 r.p.m.
Rated altitude	7,000 ft.	3,500 ft.
Take-off power	800 h.p. (total 3,200 h.p.)	910 h.p. (total 3,640 h.p.)
Weight	1,015 lb.	1,015 lb.
Power loading	15.1 lb./h.p.	13.7 lb./h.p.

Meanwhile, as a start in the survey of the southern route, *Cambria*, the second long-range Short boat, flew on Tuesday of last week to Lisbon in order to investigate the facilities there. Lisbon is the jumping-off point for the Azores-Bermuda-New York route.

THE SIKORSKY

Although in this country we have seen at least one of the older Sikorsky amphibians, the arrival of *Clipper III* provided technicians over here with their first chance of examining the latest American boat to be put in service. In basic design the S.42B is now several years old, and one can hardly make a fair comparison against the Short Empire type.



ATLANTIC AIDS : The control cabin of *Clipper III*. In the centre can be seen the Sperry panel, automatic pilot controls and r.p.m. indicators, while on either side are identical panels mounting the essential flying instruments. Below the centre panel can be seen the new Sperry Gyro-Mag compass and the engine controls are mounted in the roof. Across the centre is the rubber band for aileron parking. (*Flight* photograph.)

It is unfortunate, perhaps, that American and British "last words" should appear at alternate intervals; but, nevertheless, this Sikorsky has a general performance which is not far short of that of our newest boats. The fact that in the matter of "struttage" and lines it is apparently far from clean should give designers more to think about. At a cursory glance this Sikorsky suggests that what the eye does not see—in the way of interference drag and so forth—is even more important than we imagined.

Since the Pacific service is being operated with Martin boats we have been inclined to forget the Sikorsky and its good work. It was one of the 42s which actually made the original Pacific survey. A 42B has been used for experimental flights over the South Pacific to New Zealand, and the type is in regular use on P.A.A.'s services.

Clipper III is, like *Caledonia* and *Cambria*, a standard service boat with a bit of extra tankage. When we saw it in Southampton Water and looked at the chairs and bunks thereon, it was not difficult to imagine that someone at Miami had said, "Here, this ship is not wanted right now on its regular run; just put in some more fuel and fly it across to Ireland." In fact, of course, the tankage arrangements are special, though these extra tanks are so neatly and unobtrusively arranged on either side of the central gangway beneath the centre section that a casual visitor would not notice anything extraordinary. Otherwise, the machine is unaltered, save for the addition of a chart table and sundry navigational oddments on the port side, aft of the kitchen and tank areas.

The control cabin layout is quite the most beautifully symmetrical and tidy one that we have ever set eyes on. Controls and instruments are completely duplicated for the pilot and co-pilot—there are even two separate fore and aft trimming wheels. The centre instrument board is largely taken up with a Sperry automatic pilot panel and the necessary controls and gauges. On either side of this are two entirely self-contained and identical panels with six essential flying instruments grouped and mounted for easy attention. The instruments are arranged in two rows of three, comprising, from left to right, a bowl-type compass and an A.S.I., a directional gyro (with lateral level) and a turn indicator, and a sensitive altimeter with a rate-of-climb indicator. In order that the lower part of the cabin shall be unencumbered, the throttles, mixture controls, and airscrew pitch levers are all suspended from the roof, but within very easy reach. Mounted below the centre panel, and on the left, in this particular machine is an instrument which we had not seen before—a Sperry Gyro-Mag compass. It has been in experimental use on American lines and on K.L.M. for some time, and is likely to go into production fairly soon. Its name is self-explanatory; it is a magnetically controlled directional gyro. In other words, it is a directional gyro which provides actual rather than pre-set bearings, and employs the advantages of each type of instrument. A magnetic compass remains, after all, the basis of all navigation.

On the port side, behind the captain's seat in a small alcove, is the engineer's department. Before him are all the not-immediately-essential engine instruments, including a large temperature gauge which, by suitable switch operation, indicates the temperatures of such things as

cylinder heads and carburettors on any one of the four Pratt and Whitney Hornets. The different fuel controls are within his easy reach.

Behind the co-pilot's seat, in another alcove, is the radio operator's department. *Clipper III* carries only compact short-wave, two-way equipment with a loop for obtaining her own bearings. The wavebands covered by the equipment include those used by the American broadcasting stations, by shipping and, of course, by the Marconi short-wave D/F equipment in Newfoundland and Ireland. Medium-wave equipment would be useful for working our own comparatively low-frequency air stations and for taking bearings on many of the European broadcasting stations.

The chart table, presided over by the second officer, Mr. W. M. Masland, who acted as navigator on the flight, is of a size which would delight the heart of many of our more ardent navigators. Inset at one end is a large vergering-type compass, while above it is a small panel carrying an air-temperature gauge, an A.S.I. and a sensitive altimeter. Protruding through the hull at the other end of the table is a telescopic and periscopic drift sight. This is likely to be more useful on the westward trip, which will necessarily be made at comparatively low altitude in order to reduce the headwind effect. The emergency exit in the roof of this particular compartment was evidently used for the sextant work.

THE SIKORSKY'S TRACK

Clipper III's track over the North Atlantic was, theoretically at least, of the great circle variety, while *Caledonia's*, as explained in last week's issue, was more nearly a rhumb line. The difference in the distance covered is not, in any case, worth worrying about. Actually, the Sikorsky flew a track which consisted of two rhumb lines with the point of intersection coinciding with the central point of a true great circle track; however, Mr. Masland saw that the comparatively sharp point of the intersection (see the diagram on p. 46 of last week's issue) was cut off. Seen on a globe this track might appear as three very shallow waves with the troughs on the side of the Equator.

Since the boat obtained the greatest advantage from the following winds at a considerable height, and was consequently flown at about 10,000ft. above the clouds over most of the crossing, it was possible to use a sextant with regularity. Actually, twelve shots were made during the trip, and nine of these were what the radio people call first-class. On the west-to-east crossing the summer night is necessarily even shorter than usual, but a couple of useful planets remained to be seen throughout the night, and the sun could be shot during the daylight hours.

A certain lack of homogeneity between D/R, D/F and celestial navigation was experienced during the latter part of the trip, but it appears that the sextant was right. As Mr. Masland put it, to fly on perfect radio bearings is almost cheating, but to work fixes on doubtful bearings is a waste of time. Needless to say, the Sikorsky came in to Foynes on bearings, and that is where radio (whatever experimental work in the matter of suitable D/F wavelengths in relation to "skip" distances has still to be done) is invaluable.

The thoroughness of *Clipper III's* equipment was finally demonstrated by the appearance in one of the bunks of a perfectly good Bartholomew map of Spain and Portugal. Probably this was bought in England preparatory to the proposed trip towards the Mediterranean. It would be nice to think that the map was carried on the Atlantic crossing, if only to suggest that nothing had been forgotten. Mistakes will happen.

"CALEDONIA'S" EQUIPMENT

Components and items of equipment which were among those that played their part in *Caledonia's* successful crossing were as follows:—

The Bristol Pegasus Xc engines, which ran on Shell fuel and oil and drove De Havilland airscrews, were equipped with Hobson carburettors, K.L.G. plugs and Tecalemit oil cleaners and greasing system. Salter springs were used. Controls were by Exactor Controls, Ltd., and Arens Controls, Ltd. Smith's aircraft instruments were used, together with a Kelvin, Bottomley and Baird compass and K.B.B.-Kollsman sensitive altimeter; other K.B.B. equipment included tachometers and electrically heated pitot head. There was a Sperry automatic pilot. The radio equipment was by Marconi. In the structure of the machine Reynolds tubes were used, there were castings and Dural rivets by J. Stone and Co., while "Alclad" alloys, made by the Northern Aluminium Co., Ltd., were used for the stressed-skin covering, and a number of constructional parts, including the fuel tanks, which latter were constructed under De Bergue patents. Hiduminium alloy sheets (High Duty Alloys, Ltd.) were also used. Many small parts were supplied by Brown Bros. (Aircraft), Ltd., and a very large number of Simmonds Elastic Stop-nuts were employed. The electrical equipment consisted chiefly of Rotax components, with a number of detail fittings by D. H. Bonnella and Son; G.E.C. "Osram" lamps were employed for lighting purposes.

* * *

Clipper III made her crossing on Stanavo Ethyl aviation fuel.

PARNALLS AND PATENTS

THE directors of Parnall Aircraft, Ltd., have issued the following statement to shareholders:—

"In the Annual Report issued to Shareholders on the 31st October, 1936, and at the General Meeting on the 10th November, 1936, reference was made to the inventions and patents assigned, under the Official Secrets Act, to the Secretary of State for Air and to the claim upon the Air Ministry in regard thereto. An undertaking was given that immediately a settlement was reached an announcement would be made.

"Since the inception of the negotiations for a settlement the position has undergone a material change by reason of the fact that the scope and user (actual and potential) of the inventions have been increased far beyond original expectations. The Directors have, therefore, accepted the Ministry's view that a final settlement of the claim is at the present time impracticable because one of the chief considerations, namely, the extent of user, cannot yet be accurately or even approximately determined. The Ministry has recognised the claim in principle and, without prejudice, has offered an immediate interim payment of £25,000, which the Company has accepted. This interim payment does not in any way prejudice the Company's rights to claim further interim payments as the extent of user becomes known, nor does it prevent the Company having recourse to Arbitration at any time should it not be possible eventually to effect a settlement by agreement with the Ministry.

"In view of the very large contracts which the Ministry has already placed with the Company and of the fact that, under the Official Secrets Act, the Company has been, and still is, prevented from exploiting these inventions abroad, the Directors are of the opinion that the ultimate settlement of the claim should be of a very substantial character and in excess of that contemplated when the Company's Prospectus was issued in May, 1935.

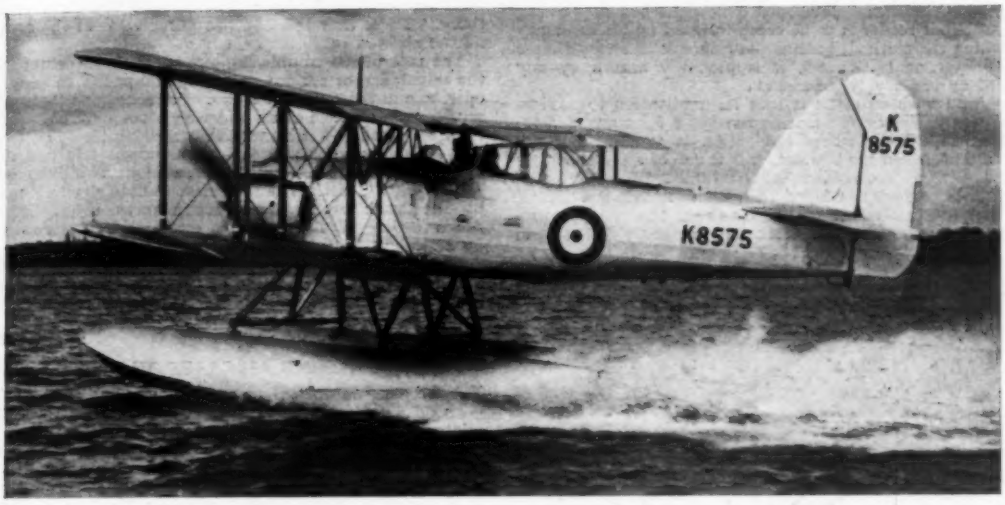
"A number of enquiries have been made by Shareholders as to the progress made by the Company since the Annual General Meeting. As the Company's financial year ends on the 31st July next, no anticipation can yet be given of the trading results for the year. The Directors would, however, like to inform Shareholders that, at the Air Ministry's insistent request, the whole of the Company's organisation has been exclusively reserved for the requirements of the Royal Air Force. Further, the Company has been operating at a profit for some months, and existing contracts alone are sufficient to occupy its Works fully and profitably for some years."

A Rolls-Royce Appointment

THE chairman and directors of Rolls-Royce, Ltd., at a recent meeting, appointed Mr. E. W. Hives to fill the vacancy on the board created by the death of Mr. Arthur Wormald. Mr. Hives has been with the company since its earliest days.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS



A FOX THAT NEVER GOES TO EARTH : Another view of the new Fairey Sea Fox (Napier Rapier VI) light reconnaissance seaplane illustrated on p. 66. (*Flight* photograph.)

JAMES MATTERN plans a non-stop flight from San Francisco to Moscow within a month. He intends to refuel in the air over Alaska.

Included in next year's R.A.F. flying programme may be a flight to South Africa by a formation of Bristol Blenheims.

An air pageant will be held on July 22, 23 and 24 to celebrate the opening of Durban Municipal Airport by the Hon. Mr. G. Pirow, Minister of Defence. The main event will be the race for the Governor's Cup and about £900.

The Government of Singapore has placed an order for a number of G.E.C. illuminated buoys for the seaplane channel in Singapore Harbour. The whole of this channel will be marked by means of these amber-lighted buoys, situated about 100 yards apart.

At the F.A.I. Conference the Jugoslav representative offered, on behalf of 14-year-old King Peter II of Jugoslavia, a permanent trophy for an annual international aircraft models contest. The first competition will be held in England next year.

Regular flights were recently made by two aeroplanes with heavy loads of food and supplies, which were dropped to 2,000 workmen cut off from the rest of the world by landslides in Zagidan, Black Sea Territory, a mountainous country where it is impossible to land.

Four Boeing YB-17 bombers (four 850 h.p. G-type Wright Cyclones) recently made a non-stop flight from Langley Field, Virginia, to Maine, across to Cleveland, and back to Langley Field. The remainder of the thirteen YB-17s ordered are being delivered at short intervals.

The *Hindenburg's* engines have been sent back to Germany, while American metal companies are bidding as high as £2,400 for the wreckage, which lies in a tangled mass at Lakehurst, New Jersey.

INSTRUCTRESS : Does a woman make an efficient flying instructor? One answer to an old controversy is provided by Mrs. A. Patterson of the South Staffs Aero Club, the first woman both to take the G.A.P.A.N. Instructor's Ticket and to obtain an instructional post. She has completed some 400 hours of instruction, and of thirty-odd pupils ten have already taken their "A" licences.

At the U.S. national gliding meeting at Elmira, N.Y., Peter Riedel, of Germany, piloted a sailplane 132 miles into Pennsylvania, and claimed to have reached a height of 8,400 ft.

At the same meeting, Carl Thompson, Jr., operated a radio-controlled robot glider for an hour, causing it to do a number of circuits and return to its starting point. It has a span of 13ft. and weighs 10 lb.

It is reported that two women, Miss Beverley Dodge and Mrs. Virginia Thomas, have reached a height of 17,000 feet on a light aeroplane; unofficially this is a U.S. national record. The world's record for Class C, first category light aeroplanes, is 20,062 feet, held for France by Mme. Madeleine Charnaux and Mlle. Clarck, flying a Farman 357 monoplane with Renault engine.

Twenty-five Years Ago

(*From "Flight" of July 13, 1912*).

"After the splendid series of demonstrations given by Com. Samson, and the naval aviators at the manœuvres a few weeks back, the presence of the hydro-aeroplanes at the Review at the beginning of this week was no novelty. Nevertheless, they did emphasise the fact that this machine is likely to prove a very valuable adjunct to naval work . . .

"On this occasion the battleship 'London,' of the fourth class, was fitted up as the mother ship, and from her deck, when steaming at 15 knots, Lieut. L'Estrange Malone flew on S.38 to the shore, a trip of 19 miles."

CORRESPONDENCE

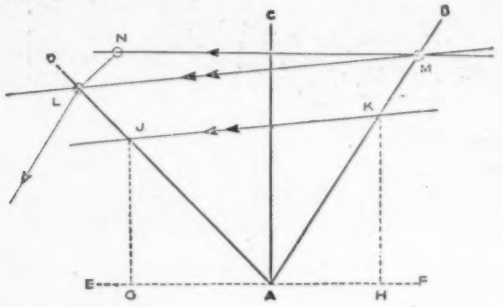
The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for publication in these columns

"RUNNING FIX"

I WAS interested to read (page 38 of the issue of July 1) of the reader who has "developed a new method of plotting his track." Your reader is to be complimented on his ingenuity in developing the method, but, as the principle is a very simple case of proportional triangles, it is probably known by any student of elementary trigonometry.

The point I wish to make is that its application to navigation has been in use by the marine navigator for many generations, and, in schools where navigation is taught, and not merely crammed into the student, this is one of the elementary problems to which the student is introduced.

Your correspondent has failed to point out that, if a "fix" can be obtained on either of the bearings, this method provides an excellent means of ascertaining the value of the wind vector.



In this diagram AB, AC and AD are the first, second and third bearings; EF is the line, at right-angles to the second bearing, with divisions, AG and AH, in proportion to time; JK is the resultant track; L is a fix on the third bearing; ML is drawn parallel to JK; M is the position of the navigator on the first bearing; MN is the course and air-speed vector; and NL is the wind vector.

This is shown in the accompanying diagram. Furthermore, to avoid confusion to the novice, the fact should be emphasised by your reader that his method will not give a *position*.

Mr. B. J. Hurren's article "Going Places," contains a remark which requires a little explanation. He states that "it is said that in the combined services, there are only two top-notch navigators, etc." Perhaps he will be good enough to define (a) "combined services," and (b) "top-notch navigator," as, unless his use of the two terms is somewhat loose, I feel that he should be called upon to justify the suggestion.

E. BROOK WILLIAMS,
Senior Lecturer,
Department of Navigation, University College, Southampton.

[We know, of course, that the principle is a well-known one, but we continue to feel that the method is simpler, more accurate and, in the end, quicker than that normally used. We were careful to point out that either method is, at present, only of academic importance. However, since the article has produced this interesting letter we do not really mind playing the simpleton.—ED.]

PILOT AND RADIO OPERATOR

WHILST agreeing entirely with Mr. Crook, who, in his article in last week's *Flight*, said that R/T is a "bad thing," I feel that the last two paragraphs of the article cannot be allowed to go unchallenged.

The root of the trouble lies, not as Mr. Crook contends, but in the reluctance of certain operating companies to include W/T operators in their aircraft crews. For scheduled "all-weather" services the absence of an operator is not only undesirable but even dangerous. With the ever-increasing traffic on air routes, and especially when approaching aerodromes in bad visibility, a pilot has quite enough to do without twiddling either an R/T or a W/T set. The "briefest routine signals" mentioned by Mr. Crook are, in these circumstances, utterly inadequate. A whole-time W/T operator is essential, and is now provided by all companies of repute.

It is difficult to see, therefore, any justification for the suggestion of mass qualification of pilots as operators—other than the benefit which would accrue to wireless telegraphy schools and instructors.

Croydon. FRANK BRENT.

MARINE AIRCRAFT TRAINING

I WAS very interested in an item in your issue of April 29 headed "Marine Flying," and dealing with the training of pilots for commercial flying boat work.

In actual fact Qantas Empire Airways fully realise the value of the experience that can be gained with a small float seaplane as preliminary training for the big boats and no fewer than eight of their pilots, including Captain Lester Brain, have taken a course of four hours each on our seaplanes. This course consisted, for the most part, of taxi-ing, approaching buoys, etc., to watch the effect of tide, wind and current.

It may interest you to know that the Royal Singapore Flying Club has, since its inception in 1928, turned out 163 Seaplane "A" licences, and, in view of the comparatively few civil pilots with seaplane experience, has amply justified the subsidy it receives from the Straits Settlements Government.

Singapore. K. B. BROTCHIE,
Club Captain,
Royal Singapore Flying Club.

[Well done, R.S.F.C.—ED.]

GENEVA OPTIMISM?

NOT having studied the text of the original argument, I will not presume to comment on Mr. S. J. Noel-Brown's letter (*Flight* July 8) on air ambulances for Spain—except as regards one particular paragraph which strikes me as too good to let slip by:—

"The said Article 18 also provides for the protection of the aircraft and its personnel in the event of a forced landing in enemy territory. Although the patients may be taken prisoner, the aeroplane and its crew are to be free to return, or will be returned, on condition that they be employed exclusively on medical or Red Cross services until the end of hostilities."

Do the pundits of Geneva, however good their intentions, honestly expect such an Article as this to be observed?

We know that the Military Mind, in a fine, sporting spirit, likes making "rules of of war" and occasionally even abides by them. But in 1914-18 motor ambulances couldn't be converted into tanks. . . .

London, W.1. C. E. E.

Forthcoming Events

July 15. Aero Golfing Society: Jubilee Cup.
July 17. Portsmouth Aero Club: Garden Party.
July 17-18. Deauville Rally.
July 18. Witney and Oxford Aero Club: Garden Party and Opening of new Witney Aeronautical College Buildings.
July 23-August 1. Swiss International Meeting.
July 24. Devon Air Day and Race: Plymouth and Exeter.
July 30-August 15. "Avia" Aero Exhibition, The Hague.
July 31. Cinque Ports Flying Club: Folkestone Aero Trophy Race.
July 31-August 2. Yorkshire Gliding Club: Opening Meeting, Sutton Bank.
August 3-September 7. Public Schools Aviation Camp, Norwich.
August 14. Eastbourne Flying Club: At Home.
August 14-22. Yorkshire Gliding Club: Open Contest, Sutton Bank.
August 20. L'Aéro-Club de France: Marseilles—Damascus—Paris Race.
August 21. Thanet Aero Club: Aviation Meeting and Race.
August 21. Midland Aero Club: At Home.
August 22-29. Italian Aero Club: Circuit of Littorio.
August 28 and 29. Cinque Ports Flying Club: Lympne International Rally and Wakefield Trophy Race.
September 4 and 5. Southend Flying Club: At Home.
September 10-11. R.Ae.C.: King's Cup Race.
September 23. Aero Golfing Society: Cellon Trophy.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

MOVE OF A GROUP H.Q.

No. 4 (Bomber) Group headquarters completed its move from Mildenhall to Linton-upon-Ouse on June 28.

FORMATION OF No. 5 (BOMBER) GROUP

No. 5 (Bomber) Group commenced to form in the Bomber Command at Mildenhall on July 1. The group is affiliated to No. 3 (Bomber) Group for all purposes until it takes over executive command of the units at the following stations on a date to be notified later:—

Hemswell.
Waddington.
Grantham.
Scampton (after October 4, 1937).

No. 5 (Bomber) Group will eventually be located at Grantham.

No. 6 FLYING TRAINING SCHOOL

The undermentioned officer and airmen have been awarded special assessments on completion of a course of flying training at No. 6 Flying Training School, Netheravon:—

Distinguished Pass

A.P/O. J. P. Dyer, A./Sergts. Lomax, E. H., and Wood, L.

No. 11 FLYING TRAINING SCHOOL

The undermentioned officers and airman have been awarded special assessments on completion of a course of flying training at No. 11 Flying Training School, Wittering:—

Distinguished Pass

A.P/O.s G. R. N. H. Jan, T. K. Milne, and B. A. Mitchell, A./Sergt. Brodie, W. C.

THE ARMY STAFF COLLEGE, CAMBERLEY

The following officers have been selected to attend the next course at the Army Staff College, Camberley, commencing in January, 1938:—Sqn. Ldrs. N. L. Desoer and J. D. I. Hardman, D.F.C., *p.s.a.*

THE ARMY STAFF COLLEGE, QUETTA

The following officer has been selected to attend the next course at the Army Staff College, Quetta, commencing early in 1938:—Sqn. Ldr. F. G. H. Ewens.

THE NAVAL STAFF COLLEGE

The following officers have been selected to attend the next course at the Naval Staff College, Greenwich, commencing in January, 1938:—Wing Cdr. R. Halley, D.F.C., A.F.C., and Sqn. Ldr. E. J. L. Hope, A.F.C., *p.s.a.*

IMPERIAL DEFENCE

The following officers have been selected to attend the next course at the Imperial Defence College, commencing in January, 1938:—Group Capt. R. D. Oxland, O.B.E., *p.s.a.*, Wing Cdrs. W. R. D. Acland, D.F.C., A.F.C., *p.s.a.*, J. W. Baker, M.C., D.F.C., *p.s.a.*, L. H Cockey, *p.s.a.*, L. N. Hollinghurst, O.B.E., D.F.C., *p.s.a.*, and H. W. L. Saunders, M.C., D.F.C., M.M., *p.s.a.*

AIR FORCE LIST

The July issue of the *Air Force List* has now been published. It can be purchased (price 3s.) from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh; 2, York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square, Belfast; or through any bookseller.

ROYAL AIR FORCE GAZETTE

London Gazette, July 6, 1937

General Duties Branch

Air Marshal W. G. S. Mitchell, C.B., C.B.E., D.S.O., M.C., A.F.C., is appointed Air Member for Personnel on the Air Council, vice Air Marshal Sir Frederick W. Bowhill, K.C.B., C.M.G., D.S.O. (July 1).

The following are granted temporary commissions as Flying Officers on being seconded for duty with the R.A.F (May 19):—Lt. W. S. G. Maydwell (The Somerset Light Infantry), Lt. E. R. E. Black (The Royal Warwickshire Regiment). (Substituted for notification in *Gazette* of June 1 concerning these officers.)

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates stated: J. A. H. Cooper, K. H. V. Day, J. P. Dyer, F. N. Hughes, R. J. Kelsey, F. O'Driscoll, B. T. Scott, J. D Stephens (July 3)· H F. Wood (July 6).

Flt. Lt. J. R. Mutch is promoted to the rank of Squadron Leader, with effect from June 1.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—M. Dawnay, J. D. Nelson, C R J. Pink, G. Thripp, D. E. B. Wheeler, J. Thompson, C. H. Brandon, C. J. P. Flood, E. C. Harding, D. P. Barclay (June 16); C. F. Newcombe (June 18). (Substituted for notification in *Gazette* of June 22.)

The following Flying Officers are promoted to the acting rank of Flight Lieutenant on the dates stated:—G. J. I. Clennell, T. B. Morton, C. H. D. Wardrop, J. H. Lowe, K. J McKay, C F. Sarsby (June 8); F. M. Smith (June 15).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—T. S. Jameson, M. M. Kane, A. G G. Baird (May 19); P. J. K. Pike, E. Banthorpe, J. A. Chorlton, A. R. Atkins, R. M. Longmore, A. G. Dudgeon, G. Elsmie, P G. S. Dickenson, W. L. Rowbottom, D. McIntyre (June 14), C F. King (June 19).

Capt. W. H. N. Martin, R.M., Flight Lieutenant R.A.F., ceases to be attached to the R.A.F. on return to duty with the Royal Marines. (Substituted for notification in *Gazette* of June 29); F/O. J. L. Yeatman (Lt. The Royal Fusiliers) relinquishes his temporary commission (June 16); Lt. R. J. Cooper, R.N., Flying Officer R.A.F., relinquishes his temporary commission on return to Naval duty (June 14); P/O. G. V. Cook relinquishes his short service commission on account of ill-health (June 28).

The short service commissions of the following Acting Pilot Officers on probation are terminated on cessation of duty (June 26): M. J. Brady, R. C. B. Swinden.

Accountant Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant (June 2):—C. A. Proffitt, W. J. R. Cann.

Pilot Officer on probation J. B. H. Hobin is confirmed in his appointment and promoted to the rank of Flying Officer (June 12).

Medical Branch

F/O. E. H. E. Cross, L.M.S.S.A., is promoted to the rank of Flight Lieutenant (June 3); Flt. Lt. J. F. Ziegler, M.B., B.S., is transferred to the Reserve, Class D (July 5).

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

The following are granted commission as Pilot Officers in Class AA (July 6):—A. E. R. Fry, A. G. Parnall, A. R. B. Tedder.

The following are granted commissions as Flight Lieutenants in Class C on the dates stated:—Sec. Lt. F. Pyle (May 27); Capt. J. Selwyn, R.A.R.O., Lt. J. H. Page (May 31); Lt. B. B. Dowling (June 1); Capt. J. E. M. Atherley (June 15).

The following are transferred from Class A to Class C on the dates stated:—Flt. Lt. P. E. Berryman (October 31, 1936); F/O. W. A. Rollason (November 5, 1936).

F/O. H. R. Kirkman is transferred from Class AA(i) to Class C (April 24, 1936); F/O. L. G. Sparrow is transferred from Class AA(ii) to Class C (March 14); F/O. F Ingham resigns his commission (March 10); Flt. Lt. C. V. Lock relinquishes his commission on completion of service and is permitted to retain his rank (June 10); F/O. J E. Whitehead relinquishes his commission on completion of service (May 1, 1936); F/O. H. D. Primrose relinquishes his commission on account of ill-health (July 7).

AUXILIARY AIR FORCE

General Duties Branch

No. 501 (COUNTY OF GLOUCESTER) (BOMBER) SQUADRON.—A. F. W. Miles is granted a commission as Pilot Officer (May 24).

No. 502 (ULSTER) (BOMBER) SQUADRON.—Flt. Lt. L. R. Briggs (R.A.F. Retired) is granted a commission as Squadron Leader and appointed to the command of the squadron (July 1).

No. 600 (CITY OF LONDON) (FIGHTER) SQUADRON.—H. Adams is granted a commission as Pilot Officer (May 29).

No. 601 (COUNTY OF LONDON) (FIGHTER) SQUADRON.—The following are granted commissions as Pilot Officers (May 7):—G. R. Branch, T. E. Hubbard

No. 602 (CITY OF GLASGOW) (BOMBER) SQUADRON.—Flt. Lt. J. H. Hodge relinquishes his commission (June 3).

No. 610 (COUNTY OF CHESTER) (BOMBER) SQUADRON.—J. H. C. Albrecht is granted a commission as Pilot Officer (May 10).

Equipment Branch

The notification in the *Gazette* of June 16, under the heading "Equipment Branch" is cancelled.

AUXILIARY AIR FORCE RESERVE OF OFFICERS

General Duties Branch

J. H. Hodge is granted a commission as Flight Lieutenant in Class A (June 3).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Air Marshal.—W. G. S. Mitchell, C.B., C.B.E., D.S.O., M.C., A.F.C., to Air Ministry; on appointment as Air Member for Personnel, 1.7.37.

Air Commodore.—R. E. Saul, D.F.C., to Headquarters, No. 11 (Fighter) Group, Uxbridge; for duty as Senior Air Staff Officer, 21.6.37.

Group Captains.—L. C. Keeble, to Headquarters, No. 17 (Training) Group, Lee-on-the-Solent; for duty as Senior Air Staff Officer, 11.6.37. L. G. S. Payne, M.C., A.F.C., to Headquarters, No. 4 (Bomber) Group, Linton-upon-Ouse; for duty as Senior Air Staff Officer, 17.6.37. A. Coningham, D.S.O., M.C., D.F.C., A.F.C., to R.A.F. Station, Calshot; to command, 21.6.37. R. Graham, D.S.O., D.S.C., D.F.C., to R.A.F. Staff College, Andover; for duty as instructor, 1.7.37.

Wing Commanders.—F. L. Hopps, A.F.C., to No. 115 (Bomber) Squadron, Marham, 8.6.37. H. E. Walker, M.C., D.F.C., to No. 99 (Bomber) Squadron, Mildenhall; to command, 21.6.37.

Squadron Leaders.—F. K. Damant, D.F.C., to Headquarters, No. 12 (Fighter) Group, Hucknall, 19.6.37. P. W. Lowe-Holmes, to Air Armament School, Eastchurch, 21.6.37. J. C. Cunningham, to No. 218 (Bomber) Squadron, Upper Heyford, 14.6.37. F. H. Shales, to No. 1 School of Technical Training (Apprentices), Halton; for Administrative duties, 14.6.37. P. J. A. Hume-Wright, to Headquarters, No. 12 (Fighter) Group, Hucknall; for Air Staff duties, 14.6.37. G. M. Buxton, to Headquarters, Fighter Command, Stanmore; for Air Staff duties, 23.6.37. J. M. J. C. J. I. Rock de Besombes, to Directorate of Intelligence, Air Ministry, vice Wing Cdr. H. E. Walker, M.C., D.F.C., 21.6.37. T. H. Moon, to No. 7 Flying Training School, Peterborough; for Engineer duties, 26.6.37. J. C. E. A. Johnson, to No. 62 (Bomber) Squadron, Abingdon; to command, 30.6.37. J. B. Barrett, to Headquarters, No. 17 (Training) Group, Lee-on-the-Solent; for Photographic duties, 27.6.37. J. Warburton, to No. 59 (Army Co-operation) Squadron, Old Sarum; to command, 28.6.37. T. J. Arbuthnot, to No. 5 (Army Co-operation) Squadron, Chaklala, India; for Signals duties, 20.4.37. L. H. Stewart, to Directorate of Signals Dept., Air Ministry; for Air Staff (Signals) duties, 28.6.37.

Flight Lieutenants.—L. W. Burgess, to No. 228 (Flying Boat) Squadron, Pembroke Dock, 15.6.37. E. B. King, to No. 2 Flying Training School, Digby, 15.6.37. G. L. Menzies, to Headquarters, No. 30 (Balloon Barrage) Group, London, 16.6.37. C. R. Lousada, to School of Army Co-operation, Old Sarum, 14.6.37. N. A. Pearce, to No. 102 (Bomber) Squadron, Finningley, 14.6.37. N. H. J. Tindal, to No. 602 (City of Glasgow) (Bomber) Squadron, 14.6.37. H. G. Blair, to R.A.F. Station, Duxford, 30.6.37. H. G. Leonard-Williams, to R.A.F. Station, Finningley, 30.6.37. A. G. Powell, to R.A.F. Station, Hawkinge, 30.6.37. D. R. Evans, to R.A.F. Station, North Weald, 30.6.37. M. K. D. Porter, to No. 2 (Army Co-operation) Squadron, Hawkinge, 30.6.37. C. M. Stewart, to No. 16 (Army Co-operation) Squadron, Old Sarum, 30.6.37. P. R. Robinson, to No. 53 (Army Co-operation) Squadron, South Farnborough, 30.6.37. P. H. Holmes, to No. 59 (Army Co-operation) Squadron, Old Sarum, 30.6.37. I. A. Scott, to School of Naval Co-operation, Lee-on-the-Solent, 30.6.37. W. N. H. Banks, to No. 233 (General Reconnaissance) Squadron, Thornaby, 16.6.37. J. J. A. Sutton, to R.A.F. Station, Heliopolis, Egypt, 2.6.37. F. A. Pearce, to School of Air Navigation, Manston, 20.6.37. E. Shipley, to No. 11 Flying Training School, Wittering, 28.6.37. G. N. Amison, to No. 501 (Co. Gloucester) (Bomber) Squadron, Filton, 27.6.37. H. J. Paine, to R.A.F. Station, Dhibban, Iraq, 1.4.37. N. C. Hendrikz, to No. 33 (Bomber) Squadron, Ismailia, Egypt, 15.6.37.

Flying Officers.—A. W. B. Barrett, to No. 5 Flying Training School, Sealand, 14.6.37. W. N. Stubbs, to No. 8 Flying Training School, Montrose, 14.6.37. T. R. Manson, to R.A.F. Station, Donibristle, 21.6.37. R. J. F. Craig, to Home Aircraft Depot, Henlow, 29.6.37.

Pilot Officers.—N. D. Guthrie, to No. 6 Flying Training School, Netheravon, 15.6.37. J. L. Wells, to No. 82 (Bomber) Squadron, Andover, 14.6.37. W. H. Cheetham, P. D. F. Mitchell, to No. 22 (Torpedo Bomber) Squadron, Donibristle, 19.6.37. B. E. R. Bowden, F. R. Jamieson, R. H. McConnell, J. R. Pennington-Legh, and I. T. B. Rowland, to No. 42 (Torpedo Bomber) Squadron, Donibristle, 19.6.37. P. A. M. Stickney, to No. 1 Armament Training Camp, Catfoss, 22.6.37.; G. W. C. Watson, to No. 82 (Bomber) Squadron, Cranfield, 14.6.37. R. J. Oxley, to No. 15 (Bomber) Squadron, Abingdon, 3.6.37. D. Marshall, to No. 34 (Bomber) Squadron, Lympne, 30.6.37. R. J. Cosgrove and D. C. F. Good, to No. 50 (Bomber) Squadron, Waddington, 30.6.37. C. L. Hullock, to No. 77 (Bomber) Squadron, Honington, 30.6.37. J. F. P. Brough, to No. 99 (Bomber) Squadron, Mildenhall, 30.6.37. J. Paine, K. R. Rogers and W. B. Wight, to No. 142 (Bomber) Squadron, Andover, 30.6.37.

Acting Pilot Officers.—W. G. Clouston and T. G. Pace, to No. 19 (Fighter) Squadron, Duxford, 30.6.37. A. D. Watson, to No. 21 (Bomber) Squadron, Lympne, 30.6.37. J. A. Meade and H. S. Shaw, to No. 77 (Bomber) Squadron, Honington, 30.6.37. P. L. Dakeyne, D. C. Mauger and E. J. C. Richardson, to No. 82 (Bomber) Squadron, Cranfield, 30.6.37. P. Campbell and J. F. Chandler, to No. 99 (Bomber) Squadron, Mildenhall, 30.6.37. J. N. G. Carter, to No. 105 (Bomber) Squadron, Harwell, 30.6.37. G. F. Dean, F. Hume, D. P. Marvin and R. E. G. Van der Kiste, to No. 206 (General Reconnaissance) Squadron, Bircham Newton, 30.6.37. C. S. Kearey, J. C. G. Macnab and G. R. Magill, to No. 211 (Bomber) Squadron, Mildenhall, 30.6.37. J. B. Murray, to No. 214 (Bomber) Squadron, Feltwell, 30.6.37. T. C. Brock, D. Devoto and J. E. Mahony, to No. 218 (Bomber) Squadron, Upper Heyford, 30.6.37. G. Smith, to No. 226 (Bomber) Squadron, Harwell, 30.6.37. A. F. Barber, B. A. Coventry, G. V. W. Davies and D. S. Munro, to No. 233 (General Reconnaissance) Squadron, Thornaby, 30.6.37. H. A. Bethune, J. C. Hamilton, G. S. P. Rooney and G. F. Witney, to R.A.F. Station, Gosport, 30.6.37.

Commissioned Engineer Officers

Flying Officers.—The undermentioned are posted to the units shown on appointment to permanent commissions, on probation with effect from 3.6.37:—H. E. Brushwood, to R.A.F. Station, Northolt. A. Clifton, to No. 6 Flying Training School, Netheravon. D. J. Day, to No. 2 Flying Training School, Digby. R. Herrick, to No. 3 Equipment Depot, Milton. W. McCarthy and F. F. S. Mattingley, to No. 11 Flying Training School, Wittering. W. Squires, to No. 6 Flying Training School, Netheravon. W. J. Scrivener, to No. 2 Flying Training School, Digby.

Commissioned Signals Officers

Flying Officers.—The undermentioned are posted to the units shown on appointment to permanent commissions, on probation with effect from dates indicated:—W. R. Lockhart, to R.A.F. Station, Kenley, 24.5.37. J. H. Styles, to No. 1 Flying Training School, Leuchars, 24.5.37. E. W. Long and A. D. Rutherford, to Electrical and Wireless School, Cranwell, 31.5.37. H. H. Laurie, to Air Ministry Wireless Section, Waddington; on appointment to a permanent commission, on probation, 24.5.37. F. H. V. Gould, to R.A.F. Station, Mount Batten; on appointment to a permanent commission, on probation with effect from 4.6.37.

Equipment Branch

Squadron Leader.—R. T. Rich, to Headquarters, Fighter Command, Stanmore, 29.6.37.

Flight Lieutenants.—A. Connock, to No. 30 (Bomber) Squadron, Dhibban, Iraq, 1.6.37. T. I. Iliff, to No. 84 (Bomber) Squadron, Shaibah, Iraq, 7.6.37. A. A. Quayle, to Directorate of Equipment Dept., Air Ministry, 8.6.37.

Flying Officers.—A. Wall, to No. 4 Equipment Depot, Ruislip, 13.6.37. G. Thornton, M.M., to R.A.F. Station, Linton-on-Ouse, 1.6.37. H. E. Bethell, to R.A.F. Station, Bircham Newton, 15.6.37.

Accountant Branch

Flight Lieutenants.—V. H. Lewis, to R.A.F. Station, Thornaby, 14.6.37. C. L. Dook, to R.A.F. Station, Linton-on-Ouse, 1.6.37.

Flying Officers.—The undermentioned are posted to the Units shown on appointment to permanent commissions, on probation, with effect from 14.6.37:—J. H. G. D. Bugden, to Headquarters, Fighter Command, Stanmore. A. F. Hall, to R.A.F. Station, Honington. R. G. P. Jaggard, to R.A.F. Station, North Coates Fitties. W. H. M. Kimpton, to R.A.F. Station, Gosport. J. W. Wallis, to R.A.F. Record Office, Ruislip. E. Bowman, to R.A.F. Station, Dhibban, Iraq, 1.4.37.

Medical Branch

Squadron Leader.—G. E. Church, to R.A.F. Station, Cranfield; for duty as Medical Officer, 21.6.37.

Flight Lieutenant.—J. A. Kersley, to R.A.F. Hospital, Cranwell, 21.6.37.

Flying Officer.—J. D. H. Cran, to R.A.F. Station, Thornaby, 24.6.37.

Dental Branch

Flying Officers.—A. J. Clegg, T. A. Gray, to Home Aircraft Depot, Henlow, 28.6.37. F. V. Frank, J. F. M. Sampson, to No. 1 School of Technical Training (Apprentices), Halton, 28.6.37.

Although its Walter Major-4 engine is rated at only 130 h.p., the Zlin XIII two-seater "looks every mile" of the 200 m.p.h. claimed for it. Incidentally, its native Czechoslovakia appears amazingly Sussex-like in this photograph.

THE PRAGUE AERO SHOW

Small Private Types Predominant : A 300 m.p.h. Fighter

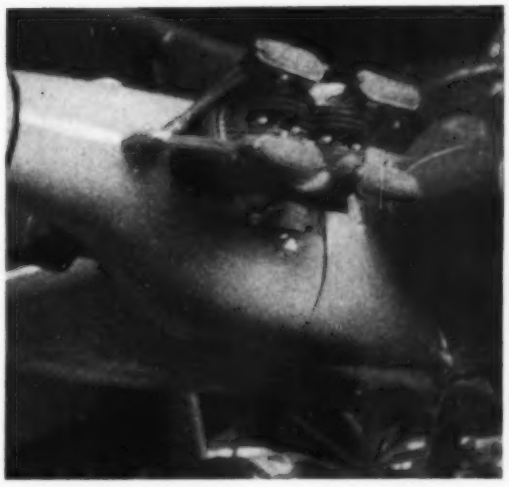
AT the tenth National Aero Show organised by the Czechoslovakian Aero Club, and held in Prague, the majority of aeroplanes on view were in the light private category, some new, and several modified or having new or re-rated engines.

The firm of Bata, known specially for their Zlin XII, have recently produced the Zlin XIII, an exceptionally clean and sporting two-seater of wooden construction. It is a cantilever, low-wing monoplane with fixed, spatted, cantilever undercarriage. Although the Walter Major-4 engine is of only 130 h.p., a speed of over 200 m.p.h. is claimed.

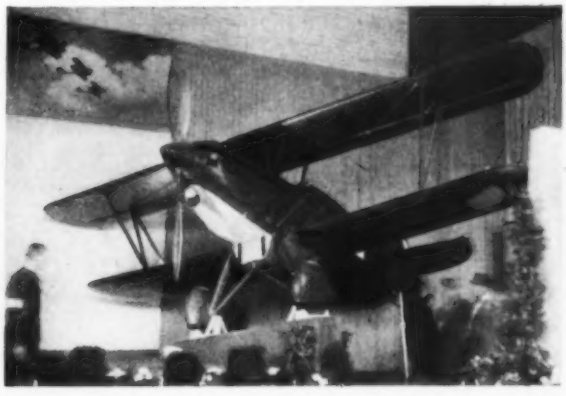
A development of the well-known Praga Baby built under licence in this country, the Praga E-115 two-seater cabin, high-winged monoplane, appeared with the Praga "D" air-cooled flat-four with an output of 65 h.p. The maximum speed is about 111 m.p.h. and cruising speed 100 m.p.h.

The Praga E.210 twin-engined, four-seater cabin monoplane was first shown at last year's Paris Exhibition. The pusher installation of the two 85/95 h.p. Walter Minor engines is interesting, and a modified tail unit now employs twin rudders.

An interesting newcomer at the Show was the Tatra T-1, the first aeroplane to be both designed and built at the Tatra



The installation of the 65 h.p. flat four, air-cooled Praga D engine in the Praga E-115 is unusual and interesting.



Two photos taken inside the Industrial Palace at Prague depict (left) three machines in the historical section and (right) the Avia 34 single-seater fighter with 650 h.p. Hispano-Suiza liquid-cooled engine.

works. It is a cantilever, low-wing, cabin monoplane to seat two. The wings are wholly of wooden construction with ply and fabric covering; a welded steel tubular structure is, however, used for the fuselage, which is also fabric covered. An air-cooled, inverted, four-cylinder engine built under licence from Hirth is the power unit, and with an output of 100 h.p., the speeds are 125 m.p.h. for cruising and 145 m.p.h. maximum. Other dimensions include span and length of 29ft. 6in. and 23ft. 7in. respectively, weight empty 981 lb., and total weight 1,543 lb. The landing speed with flaps is 46.5 m.p.h. and the normal range 465 miles.

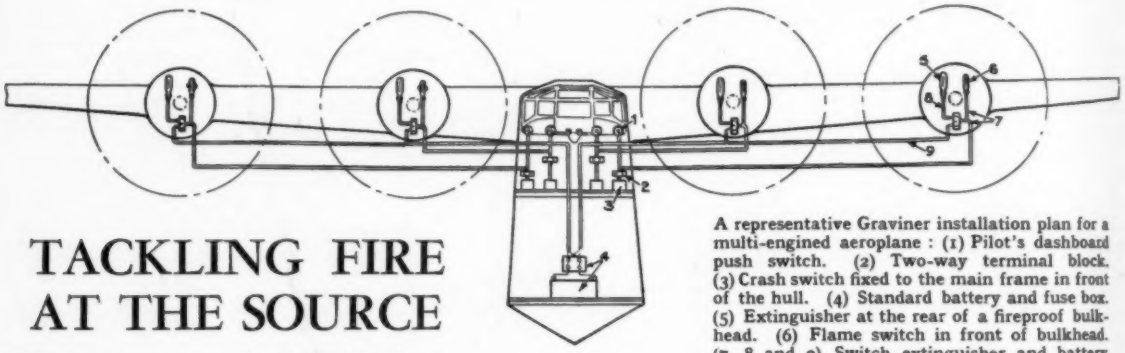
Three trainers built by Tatra were also to be seen, and these included the T.131 two-seater biplane built under Bücker licence and the 350 h.p. T.126 built under Avro licence.

A quartet of wooden, low-wing, cantilever monoplanes were displayed by Benes and Mraz. The Beta Minor Be.50 and 51 are two-seaters with Walter Minor engine, and differ only in having an open cockpit in the case of the 50 and a closed one for the 51. Seen at the Brussels Exhibition, the Be.550, or Bibi, has a 50 h.p. Walter Mikron engine. Largest of the four, the Be.56 has an 120/130 h.p. Walter Major-4 engine, and is a single-seater specially stressed for aerobatics. The machine has a maximum speed of 150 m.p.h.

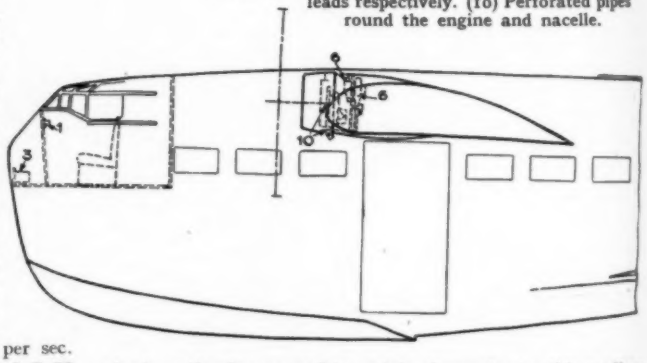
Only one aircraft represented the commercial side at Prague, the Aero A.204. With retractable undercarriage, this modern eight-passenger, metal monoplane, which also carries a crew of three, is said to be capable of 200 m.p.h. with two Walter Super-Castor engines. The weight loaded is 9,480 lb., the span is 62.3ft. and the length 42.6ft.

One or two outstanding exhibits were displayed in the military section. The Avia 35 single-seater fighter is an all-metal, low-wing, cantilever monoplane with retractable undercarriage and 1,000 h.p. engine. A speed of 310 m.p.h. is claimed. A 600 h.p. Rolls-Royce Kestrel VI powers the Praga E.45 single-seater fighter biplane, and a similar machine, the Avia 34, has a 650 Hispano-Suiza engine. The Aero MB200 bomber is built under licence from Marcel Bloch.

Among the engine exhibits could be seen Bristol Mercury and Pegasus, and a new Walter Mikron II with an output of 60-62 h.p. at 2,600-2,800 r.p.m. The bore of this unit has been increased by 3 mm. to 88 mm., and the compression ratio from 5.2 to 6.1 to 1. This modified Mikron now weighs 134.5 lb. A new direct-drive Praga D flat four is of 2.8 litres capacity and gives 80 h.p. at 2,520 r.p.m. This rating is a maximum continuous power for thirty minutes. A geared version of the Praga D with increased compression has a maximum output of 90 h.p. at 3,000 r.p.m. The firm are now producing an inverted, air-cooled six-cylinder engine of 10.3 litres capacity from which a normal output of 220 h.p. and a maximum of 300 h.p. is obtained. The weight is 485 lb.



A representative Graviner installation plan for a multi-engined aeroplane: (1) Pilot's dashboard push switch. (2) Two-way terminal block. (3) Crash switch fixed to the main frame in front of the hull. (4) Standard battery and fuse box. (5) Extinguisher at the rear of a fireproof bulkhead. (6) Flame switch in front of bulkhead. (7, 8 and 9) Switch, extinguisher and battery leads respectively. (10) Perforated pipes round the engine and nacelle.



TACKLING FIRE AT THE SOURCE

FOR many years past the Air Ministry has been testing various forms of fire extinguishing installations for aircraft use. It is interesting to enumerate and examine the qualities demanded, especially in view of the fact that it is now possible to describe certain equipment, produced by the Graviner Manufacturing Co, (of First Avenue House, High Holborn, London, W.C.1), to comply with these requirements. The first is that the total weight must not exceed 12 lb. The weight of the complete Graviner extinguisher is less than 12 lb., including 6¼ lb. of methyl bromide, said to be the most effective extinguishing medium known for the type of fire. (2) The extinguisher must work automatically and instantaneously in a crash, spraying the engine and interior of the cowling with the methyl bromide, discharge being completed in three to five seconds. The difficulty in this connection is to decide what constitutes crash conditions. An aircraft when it is decelerated at 5 to 6 g (g=32ft. per sec. per sec.) will suffer structural damage, but at 2 to 3 g no damage should occur. A bad landing or severe aerobatic manœuvres may produce accelerations near to crash conditions but must not operate the automatic valve. (3) The extinguisher must operate automatically when fire breaks out, because immediate action is required in case of fire in the air or on the ground. This is not too easy to arrange, as operational temperatures of engines and in the cowlings are quite high. (4) A hand-operated switch must be provided in the cockpit to effect operation at any time it may be required. (5) The extinguisher must be useful as a hand extinguisher when detached from its bracket. An additional fitting obtainable with the Graviner equipment, which satisfies all these demands, is a petrol cock which instantly shuts off petrol in the case of a crash.

Carbon dioxide is the more usual extinguishing medium in the United States, and, like carbon tetra-chloride, it depends upon the blanketing action of the gas. As a medium carbon dioxide is compressed in bottles, and the apparatus is inclined to be on the heavy side. Carbon tetra-chloride apparatus may also be rather heavy, and in certain circumstances this medium produces chlorine and even phosgene when sprayed on hot metal parts. Both these gases are poisonous. Methyl bromide has less toxic decomposition products than carbon tetra-chloride, and the weight of the Graviner apparatus has been kept under 12 lb. with 3¼ pt. of this medium.

Methyl bromide is specified by the Air Ministry in this country. It is a liquid when under pressure which evaporates with intense lowering of temperature, when liberated.

In the Graviner apparatus the extinguisher proper is a three-pint copper bottle having a very simple patented form of discharge head with an electric fuse permitting complete discharge in a few seconds. Pipe lines from a junction box engaging the head lead the methyl bromide to various key points in the engine or engines and cowling. On operation jets of the medium are played on the hot parts and, due to the intense cooling effect, the temperature of the metal is reduced below the ignition temperature of the fuels, or if fire has already broken out the powerful inhibiting action of methyl bromide comes into play.

A Centuries-old Subject Examined from a New Angle: Some Practical Experiments with the Human Engine

By GRANVILLE BRADSHAW, O.B.E.

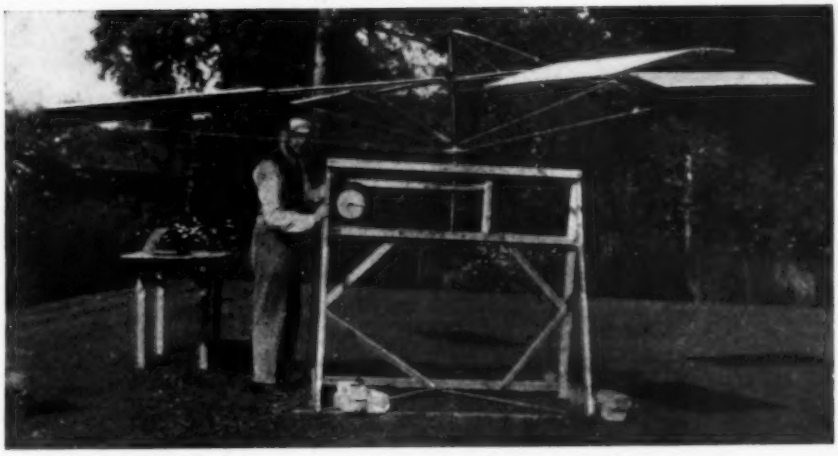


Fig. 1.—The experimental lifting rotor which gave indifferent results.

MAN-POWER FLIGHT

HOWEVER sceptical readers may feel about the problem of man-power flight, they must admit that the author of this article has worked out a novel and interesting line of attack. Incidentally, he appeals to gliding experts to help him with certain data. Mr. Bradshaw, whose inventions in many fields have achieved real success, was one of the pioneers of British aviation in that he designed and produced aero engines as early as 1911. In the following year one of his A.B.C. engines established a record by flying for more than eight hours in a Sopwith-Wright biplane piloted by Harry Hawker. During the war Mr. Bradshaw designed the A.B.C. Dragonfly and other radial engines, which were remarkable for their low specific weight.

EDISON has been called "the greatest inventor of all time," but I do not believe that he ever "invented" anything in his life. Not what we call *invention*. He was far too practical in his methods. What he did, for instance, was to ask himself if sound could be recorded, and then, starting at the beginning he worked upon a process of technical research, experiment and development until the device assumed a practical form and finally emerged as a *fait accompli*.

Nowadays there is too much accumulated knowledge and data necessary to success in technical subjects for one to be able to sit down and to "invent" a new and immediately successful process. Probably the only inventions that can truly be described as inventions are small gadgets like patent fasteners, potato peelers, tin lids, and miscellaneous devices one sees in an industrial exhibition.

Being convinced of the desirability of research methods and equally convinced of the possibilities of flying by manual effort, I have spent a great deal of time during the past twelve months in carrying out some experimental work which might bring it a few stages nearer to a solution.

My friends in aviation technique have always said that man cannot develop sufficient b.h.p. ever to be able to fly. This, of course, is easy to appreciate if one's views are bounded by the theory and practice of aeroplanes of the type originated by the Wright Brothers.

To State the Case

What I have never been able to get out of my mind is the fact that man undoubtedly possesses sufficient power to lift himself from the ground. He can, for instance, raise himself on his toes, he can climb a ladder, walk upstairs, hoist himself with his arms, can jump several feet above the ground, and, when it comes to leverage, he can lift as much as a ton or more.

Why, then, hesitate to agree that he *ought* to be able to fly? If man can lift himself comfortably and easily with one hand by means of a rope over a pulley, surely all that he requires in order to fly is the right kind of pulley?

Often have I said to myself, "Supposing man could stand on a light 'air-borne' aeroplane and could jump and then lift the aeroplane after him, then jump again and carry on and on?" This, in a crude form, would be flight by manual power.

These things naturally pass through one's mind when seeking a solution to a problem like this, especially as one obviously realises that it must be some revolutionary device if success is to be achieved.

I first decided to study man as a motor, and for my first experiment I went to Leicester Square Underground, where they have the longest escalator in London. The centre stairway, which was stationary, consists of 120 steps each eight inches high, a total of 80 feet. On an automatic weighing machine I weighed 148 lb. I took out my stop watch and ran up the stairs in 40 seconds almost exactly (and very nearly dead!). This shows that my legs developed 0.54 b.h.p. I have since discovered that 8 in. steps are not necessarily the best for the human form for a test of this nature—for instance, 6 in. steps suit me better, and running two steps at a time gave more rapid ascent, with the result that the power would increase to approximately 0.65 b.h.p.

Three or four trials satisfied me, as you may well expect, that if manual-power flight would necessitate anything approaching the amount of effort that I had just expended, it would not be worth having even if it were possible. On the other hand, I realised that I was ascending at least ten times as fast as would be necessary to satisfactory flight.

Flying or Hopping?

I think it will be agreed by everybody that flight by manual effort will be useless if the human is not able to keep flying for an hour at least and without a heart attack; otherwise it is merely interesting for academic reasons and possibly for a few hundred feet of newsreel.

However, I started with an open mind in order to find out what I could, and I decided to let it lead me where it would.

I then built a lever mechanism on a spring balance to test the power of the arms, and was not at all surprised to find that man can develop quite as much power by his arms as by his legs. Our ancestors back through the ages of evolution to the days of the anthropoid ape used to swing from tree to tree, hanging on their arms and using the powerful breast and back muscles. We have undoubtedly retained some of the original strength in these same muscles.

I found that, rowing fashion, I could pull more than 100 lb. a distance of four feet at nearly fifty strokes per minute, which give a b.h.p. of 0.65.

Therefore the b.h.p. of an ordinary person may be reckoned at between 1¼ and 1½.

From these and subsequent tests I would estimate that supermen in first-class training, like the Oxford and Cambridge boat race crews, are each developing between 2½ and 3½ b.h.p. in a race of that description. It has been demon-

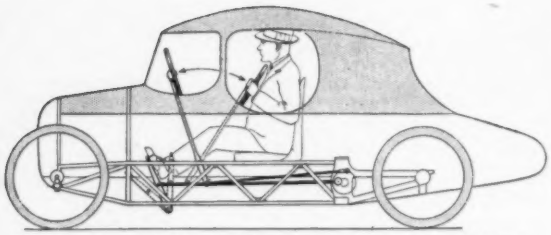


Fig. 2.—The author's experimental cyclecar, propelled by a carefully worked out combination of leg and arm power.

strated that a good cart-horse can develop from 12 to 16 b.h.p.

I carried out many other tests on the human "engine" with some astonishing results, which we will discuss later, it being sufficient at the moment to say that it appears to be the most variable, most flexible, most inconsistent, and the most bewildering device ever "invented."

You cannot treat it like a petrol engine, the crankshaft of which you know will give you (say) 100 b.h.p. at 2,500 r.p.m. —*which you can employ as you may wish.*

Try to get power out of a human motor in the wrong way, such as by using the wrong muscles, or in the wrong line of thrust, or at the wrong speed, and you will find perhaps only 10 per cent. of what you might otherwise expect. Alternatively, give it some inducement, and it will stand a 300 per cent. overload and will enjoy it.

This being the case, I decided that an ounce of practice was worth a ton of theory. One well remembers that in the early days of flying the mathematicians produced extensive calculations to prove that certain new machines would not fly, but they did fly, and the problem of flight by manual power may well be in the same category to-day.

My next effort was to test man's ability to propel an aerofoil through the air. I had given up all thought of thrusting planes forwards by means of an airscrew, because I realised that they would be getting their lift second-hand, and I knew that I could not afford airscrew losses.

The Wrong Kind of Lift

I argued that if planes are designed to lift at (say) 30 m.p.h., why not push them round at 30 m.p.h. by the engine itself and measure the lift direct? I had made arrangements for forward travel by the tilting of the surfaces to a slight angle in the direction I wished to travel which, of course, gave a horizontal component. Incidentally, this part of the device worked quite well. I therefore built a large testing rotor, which is illustrated in the heading photograph, Fig. 1. It would not be difficult to predetermine the amount of engine power required to turn it, but that would tell me nothing about manual power and physical reaction, which I considered to be all-important.

As I have said, man is a curious animal and does not obey mechanical laws as we are accustomed to them. For instance, one might think that on a pedal cycle it is only necessary to have a gear ratio low enough, and one would be able to climb any hill in the country. But it is not so, as man's physical properties refuse to cope with it; therefore a low first speed, as in car practice, is quite useless.

The rotor had four orthodox blades each 4 ft. long by 2 ft. 2 in. chord and of a well-known section. The outside diameter was variable from 10 ft. to 16 ft., and the angles of incidence of the plane surfaces were cross-connected in pairs, which was found necessary in a wind, as one side would lift more than the other. The angles of all four planes were controlled by one lever giving a complete range from a negative angle to that of a steep climb.

The whole rotating member was carried upon a universal joint for purposes of the tilt above referred to.

The results were extremely disappointing, and all the power seemed to disappear in head resistance.

I was, of course, well aware that we had less than 1½ b.h.p. to play with, but with the total of about 200 lb. thrust of which man is capable, and the "fine-pitch thread" upon which this was working, I did expect more than the 30-odd lb. lift that I obtained. And the effort was infinitely worse than running up the Leicester Square stairway. Even with no lift on the blades at all I could not rotate them any appreciable amount faster than I could at the maximum lift.

However, I had satisfied myself, in the only way in which I could obtain complete satisfaction, that lift of this kind is definitely unsuitable for man power.

One has seen reports in the Press that flights of short duration have been made by man power, and it may be that some athlete has scraped off the ground by almost superhuman effort, but the absence of confirmation leads one to think that no real measure of success has been achieved.

It is the *type* of effort which is all wrong—that dreadful drag which can be likened to pushing a car through thick mud. The physical form likes spring and rebound, and, above all things, it likes rhythm in its actions.

It is possible that I did not build the most efficient type of test machine and that considerably greater efficiency could have been obtained, but I am satisfied that as a type for operation by manual power it is useless.

I feel quite sure that if the wing power of a bird were converted into continuous torque and used in known aeroplane manner it would not succeed in lifting the bird off the ground.

I became more and more convinced that I must seek lift of a different kind, and I returned to the problem of working upon a large plane surface and using it as a stepping stone.

Since that time I have frequently lifted myself from the ground and have become "airborne" by the simple process of forcing a plane surface smartly downwards at right angles to its face; and it required no more effort to lift myself and the weight of the plane than jumping over a stile.

This is not flying (yet), but it appears to be a more efficient form of lift than the one commonly used. It is lift by reaction as compared with lift by drag, and I believe that very little effort is lost in obtaining lift of this description.

"Reaction Lift"

My technical friends will say "the ornithopter, of course," but I cannot entirely agree, although there is a little similarity. A flapping wing, to my mind, presupposes air disturbance, and this causes loss of power. You cannot start air or water in motion and leave it to carry on without having lost the power that set it in motion. My aim is rapidly to compress the air under the plane locally and to benefit by the rebound.

A flapping wing, with its radial action, would appear to be almost doing its best to throw the air off. Reaction lift, therefore, may well be a step in the right direction. It uses the manual motor in a way to which it is accustomed and which it likes.

Solid drudgery, like turning an airscrew, the human engine will not stand—was not the treadmill designed as a punishment?

I therefore decided to work upon these "reaction lift" lines as the most likely to produce results.

The next stage was to endeavour to find the best arrangement or combination of our two kinds of power, i.e., the legs and the arms, and for this purpose I built a small cyclecar weighing 55 lb. This is illustrated in Fig. 2, and in it I must have tried over twenty combinations and arrangements.

For the arms I can find nothing better than a rowing action; therefore the whole steering wheel and column rocks to and fro, and the extent of their travel can be adjusted whilst the car is moving. It is astonishing how easy it is to get into the habit of rowing and steering at the same time. It seems perfectly natural to swing the body when the legs are pedalling.

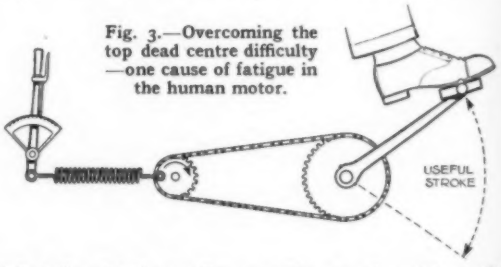


Fig. 3.—Overcoming the top dead centre difficulty —one cause of fatigue in the human motor.

I first thought that ordinary rowing practice with a sliding seat must be the best (and probably *is* the best) manual power producer in common use to-day, but I do not think that it is quite the best that could be done. In fast rowing with a sliding seat the leg power is, we might say, in series with the arms, i.e., the power that is produced by the legs is transmitted to the oars via the arms—I have tried them in parallel and with adjustments for the separate travel and leverage of each, and I have found considerable improvement.

Rotating pedals as in ordinary cycles appear to be of a low order in manual propulsion. The rotary motion of the feet and lower limbs brings into play secondary muscles that were never intended for heavy pressure. These muscles are easily overstrained and tired, especially when pedalling a bicycle up a hill with the rider trying to force the pedals forward at the

top and backward at the bottom of the working strokes. Perhaps the most valuable thing that I discovered is the fact that the human engine becomes more tired and loses its power more readily when it is straining at something which is stationary than when it is doing work. For instance, if the foot is pressing against a fixed pedal it will tire more quickly than if it is moving the pedal against an elastic medium.

Muscles apparently were not designed for stationary strain, and it may be that the circulation of the blood has something to do with it, or possibly the muscles become "knitted," or the lubrication of the joint fails. There is certainly some truth in the old saying that when the potter is pedalling his wheel it is the leg that is standing on the ground that becomes tired, and not the one that is doing the work.

The most tiring period of pedal action on a hill is the slow part just over the top dead centre (I mean slow with respect to the straightening of the leg), and this tiring part of the stroke is the very part which is doing the smallest amount of work. Thus millions of cyclists are probably wasting energy every day.

The human engine is different from, shall we say, the steam engine. We all know that in a steam engine the crank, when in a certain position, is at a bad angle for turning effort, but at the same time we know that energy is not being lost, for the simple reason that the piston is moving correspondingly slowly, and consequently little steam is being taken from the boiler.

In our manual engine, however, the very fact that the leg is moving slower than the minimum rate for manual efficiency is the very thing that is causing a loss of manual power by overstrain, and so we have to get off and walk. No other engine loses energy or power in this manner.

We have seen efforts made by inventors to overcome the "top dead centre" trouble, but seldom do they appear to be sound in principle.

I decided to endeavour to overcome this drawback by providing a torque equaliser. I could see no way in which I could alter the crank, so I decided to alter the torque. I thought that I would ask for more power at the easy part of the travel, and give it back again at a time when the legs were being overstrained, and this proved successful. The device is simple and is illustrated in Fig. 3.

A *Torque Equaliser*

Briefly, it is a two to one gear, an additional small crankshaft, and an adjustable spring of about 60 lb. maximum tension controlled by a lever. The pedal crank is easy to push down during about one-quarter of a revolution, as shown in the diagram and marked "useful stroke," and during this quarter of a revolution the spring crank (which turns at twice the speed) obviously moves through half a revolution and tensions the spring. It is timed to pass over the dead centre at the end of the useful part of the pedal stroke, and during the time that the pedal crank is passing through the tiring quarter of a revolution the energy stored up in the spring is given back with a mechanical advantage of two to one on account of the gear ratio. The result is that the drudgery has disappeared, the machine feels light and lively, and where one would expect to feel the strain of pressure the machine actually travels forward on its own. The spring is adjustable by a gear lever, and, like changing speed on a car, it has to be suited to the hill.

A surprising thing is that, possibly because the manual motor is relieved over the tiring patch, it does not notice the additional push it has to give during the easy part of the stroke.

There can be no doubt but that the manual motor is at its best when it is overcoming a quick and springy resistance. It is best likened to volleying at tennis, with all one's effort thrown into a terrific swipe at the ball.

On this manually propelled car I have started from rest quite comfortably on a one in five gradient, and have exceeded 40 m.p.h. on the level. Therefore I feel that I am obtaining a considerable amount of the right kind of b.h.p. from the manual engine. I am sure that a rowing "Blue" would exceed 60 m.p.h. without difficulty.

This arrangement of gear, however, will not be the most suitable for our flying machine, the aim in which is a bouncing push on a large flat surface at regular intervals with which to lift the fuselage and pilot, which is the first essential. For this latter purpose the gear which I have tested is a plain lever with cross-bar gripped by both hands and two pedals carried upon another lever, the two levers being coupled together so that they are slightly out of phase. The reason for this is that the greatest power period in rowing is the final jerk which is customary just near the end of the stroke. The feet also like to give an extra jerk, but it does not appear to be efficient for them both to do it at the same time, as they each like the extra jerk when it suits them best; therefore the rhythm is "pull-jerk jerk, pull-jerk jerk," and so on. It may sound tiring as read, but it is quite a pleasant and smooth action in practice, and it removes the possibility of a "dead centre," which may be dangerous in the air from the point of view of control. (We must not forget that whilst pedals can only push downward, the hands can both pull and push, but I have disregarded the push with the arms for increasing power, as it takes away the rest period, and I have retained it only for helping the controls.)

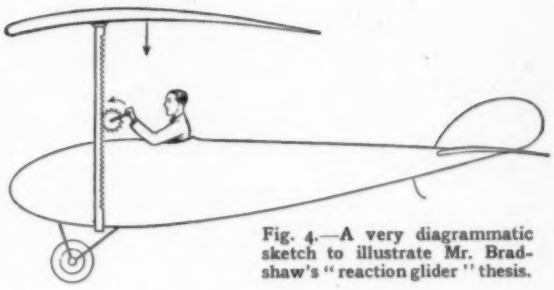


Fig. 4.—A very diagrammatic sketch to illustrate Mr. Bradshaw's "reaction glider" thesis.

I feel that I have definitely proved that lift by reaction is sound and efficient. I believe that, except for pure speed, it is many times more efficient than lift by drag, and that all that we have to do is to find a satisfactory means of employing it.

Work to be done

In my first attempt at the complete machine I am working upon the slowest speed I can obtain, and this is where I am asking for constructive criticism from readers with experience in the design and testing of modern gliders. I shall be grateful for any figures.

Supposing we can build a glider weighing 80 lb. (which with pilot at 150 lb. will be 230 lb. in all), and supposing it can maintain a gliding angle of 1 in 30 at 8 m.p.h. in still air. (What are the best figures for modern gliders, by the way?) If we can do this, then our rate of vertical descent is 24 ft./min. We must, therefore, raise 230 lb. at the rate of 24 ft./min. in order to fly level, i.e., to change a 1 in 30 glide into horizontal flight. If we row at forty-eight strokes per minute we must lift the weight 6 inches at every stroke.

Let us take 150 lb. of the weight on the arms and the remaining 80 lb. on the legs and see what the figures are.

The arms have a stroke of (say) 3 ft., which gives them a leverage of 6 to 1 (on 6 in. lift), and this will necessitate a mean pull of 12½ lb. on each arm. The legs have a stroke of 18 in., giving a leverage of 3 to 1, and this is a mean push of 13⅓ lb. on each leg. Neither of these efforts would be a discomfort to man, and, in fact, the leg push is consistent with the average push on a pedal cycle; therefore we may assume that the arms provide the necessary further power to produce the lift.

There will be no loss in the transmission as there would be with an airscrew, and the power necessary to maintain the lifting of 230 lb. a height of 24 ft. every minute is actually less than one-fifth b.h.p. The problem with regard to the power aborbed by head resistance is a curious one. Our glider, for instance, would normally glide at its natural gliding angle losing height all the time *but still gliding downwards and forwards*, and all that we are seeking to do is to restore height. I have already developed what appears to be a satisfactory method of raising the fuselage and pilot with respect to the planes on the reaction principle to which I have referred, and of restoring the planes to their former height, all with no appreciable loss and without interfering with the glider gliding as a glider should. I have also provided for additional forward velocity by altering the angle of reaction.

Where is the snag? It is merely a glider on which a weight is raised whilst it is in flight. If the weight is greater or the natural gliding angle of the machine is steeper than 1 in 30, then one will have to row harder, but if the gliding angle were 1 in 60, for instance, then one would only require one-half the above power. If the gliding angle is 1 in 30 and the principle of lift by reaction is as efficient as I think it is, the power required to fly level should be no more than that necessary to climb a gradient of 1 in 30 with my test cyclecar loaded up till it weighs 80 lb. all told, and this, I find, is child's play.

I have built a fuselage the complete weight of which with hand and pedal gears is 9½ lb., and I have developed a strut

and a spar which are lighter than anything I have yet seen. An extremely stiff and strong oval section, 2 in. by ¾ in., weighs less than 1 oz./ft. run, and joints of equivalent strength weigh 0.5 oz. each.

Let us now try to explain the principle of my present efforts in the simplest manner possible. Fig. 4 is an imaginary glider gliding down in the usual way. A man is sitting inside and is winding himself and the fuselage upwards with respect to the planes (this is merely to explain the principle, as, of course, it is nothing like this in the practical mechanism). The combined weight of man and fuselage is, say, 80 per cent. of the total, therefore he must lift this weight approximately 20 per cent. more than the equivalent vertical descent due to the gliding angle. The mechanism then releases the planes, and, by virtue of their lift from forward travel, they rise to their original level, and the man and fuselage descend the 20 per cent. in connection with this last operation.

The particular method of performing all this is immaterial at the moment, and I hope that readers will agree with me that it is perhaps better not to disclose it for the time being. They can rest assured, however, that the action is smooth and satisfactory, and the only question remaining is one of glider efficiency.

A glider must be made to come within the figures I have given above. We know that many gliders can glide over 50 miles from a height of 1 mile (5,280 ft.), probably with the pilots looking for "thermals" all the time. It would be interesting to know their distance in still air from the same height. On the other hand, if a glider can take advantage of ascending currents, we can do the same and can "rest on our oars," always feeling that with a little rowing we can get over the flat spots, and this, I imagine, most gliding enthusiasts would welcome.

I have built a model with a 3 ft. span, and, lifting by reaction as above described, it will jump straight off the ground, carrying four times the weight that can be expected from the usual airscrew-driven model of the same size even when launched by hand.

It closely follows the laws of lift by a crane, inasmuch as twice the power will lift approximately twice the weight.

I have not completely solved the problem of control in the air yet, and I am satisfied that it is a waste of time to try to determine this from a model.

Even with the best of known types of models, it is difficult to get a good flight, and with an entirely new principle the quest is well-nigh hopeless because one can spend hours in trying some variation in a certain gear, only to find that some tiny alteration of rudder, wing tip, or elevator from the last bad landing has taken away all chance of a comparison.

In a case of this kind it appears essential to have the foresight, control, and immediate action that can only be obtained with a pilot at the helm.

COMBINED COAST DEFENCE EXERCISE

The Fleet Air Arm versus *Shore-based Squadrons*

COMBINED coast defence exercises are now in progress on the south coast. They began at 15.00 hours yesterday, July 14, and will finish at 15.00 hours on Friday, July 16.

The attacking force, designated the Blue force, consists of several battleships (representing cruisers), cruisers, destroyers and submarines and two aircraft carriers which will have on board six squadrons of the Fleet Air Arm, with a strength of 69 aircraft. There will also be ten other aircraft on the capital ships and cruisers, making a total air strength of the Blue force of 79 aircraft.

The Red defending force consists of a mixed naval organisation consisting of one cruiser, destroyers and submarines, twelve squadrons of reconnaissance, bomber and torpedo bomber aircraft with a total of 146 aircraft, and the fixed coast defences and anti-aircraft defences at Portsmouth, Portland and Plymouth. Units of the Observer Corps (Royal Air Force) are also employed on air intelligence duties in the neighbourhood of Portsmouth. The military and air forces are controlled by General Sir John T. Burnett-Stuart, Commander-in-Chief, Southern Command, and Air Marshal P. B. Joubert de la Ferté, Air Officer Commanding-in-Chief, Coastal Command, Royal Air Force

Briefly, the exercise, which is of a training nature, has been drawn up with the following objects:—

(*a*) To test the command and co-ordination of the defences—naval, air and land—of the fortresses of Portsmouth, Portland and Plymouth.

(*b*) To study the detailed handling of the forces engaged in the defence.

The exercise centres round the general idea that Redland is an imaginary country situated where England now is, and Blueland is an imaginary country in the Atlantic situated about 600 miles west of Redland. Redland has four naval bases or ports which are of such military importance that a successful bombardment might have an appreciable effect on the conduct of the war. They are Portsmouth, Southampton, Portland and Plymouth. Blueland has a naval base at Port X, situated in latitude 50 deg. North and longitude 19 deg. West.

A state of strained relations has existed between Redland and Blueland since July 1. Redland have mobilised their defences, and submarines and air patrols have been instituted to give warning of any sudden attacks by Blueland.

The forces taking part in the exercise include:—

ROYAL NAVY.—Battleships (representing cruisers), aircraft-carriers, cruisers, destroyers and submarines of the Home Fleet; and local destroyer and submarine flotillas of the Home Port Commands.

THE REGULAR ARMY.—Royal Artillery fixed defences of the South-Western Ports and Southern Ports; two companies of the 1st Anti-Aircraft Battalion, R.E.; and the School of Electric Lighting.

THE TERRITORIAL ARMY.—The Hampshire, Devon, Suffolk and Glamorgan Heavy Brigades, R.A., and the 56th Cornwall and the 57th Wessex A.A. Brigades, R.E. (in cadre only); and the Fortress Engineers of Hampshire, Cinque Ports, Essex, Dorset, Suffolk and Devon and Cornwall.

ROYAL AIR FORCE.—All Red air forces, with the exception of Nos. 1 and 74 (Fighter) Squadrons and units of the Observer Corps, are under the command of Air Vice-Marshal H. M. Cave-Brown-Cave, C.B., D.S.O., D.F.C., Air Officer Commanding No. 16 (Reconnaissance) Group, Royal Air Force. Nos. 1 and 74 (Fighter) Squadrons and Observer Corps are under the command of Air Vice-Marshal E. L. Gossage, C.B., D.S.O., M.C., Air Officer Commanding No. 11 (Fighter) Group, Royal Air Force.

DETAIL OF RED FORCE.—No. 201 (F.B.) Squadron, London; No. 204 (F.B.) Squadron, London; No. 209 (F.B.) Squadron, Singapore; No. 210 (F.B.) Squadron, Singapore; No. 22 (T.B.) Squadron, Vildebeest; No. 42 (T.B.) Squadron, Vildebeest; No. 99 (B.) Squadron, Heyford; No. 206 (G.R.) Squadron, Anson; No. 220 (G.R.) Squadron, Anson; No. 269 (G.R.) Squadron, Anson; No. 1 (F.) Squadron, Fury; No. 74 (F.) Squadron, Gauntlet.

Four aircraft have also been allotted for coast artillery co-operation.

From the Air Force point of view the principal object of the Red Air Force is to train air units in the defence of defended coastal areas against attack by a hostile fleet and ship-borne aircraft. As regards ground defences, No. 810 (Fleet Torpedo Bomber) Squadron (which is not included in the units available either to Red or Blue Forces) has been disembarked from the Aircraft Carrier *Courageous* and will be employed specially in order to carry out flights over that part of the Portsmouth area which is manned by the Observer Corps. The Air Officer Commanding No. 11 (Fighter) Group will also route his fighter aircraft over some of the observer sectors in order to give observers further practice in locating aircraft.

During one phase of the operations in the vicinity of Southampton and Portsmouth it is intended, with the help of the local authorities, to test out the air-raid precautions schemes in that locality.

Mussolini Junior, Record-breaker

AN achievement that carries both civil and military importance is the setting up on July 8 of three new records by Lt. Bruno Mussolini—Signor Mussolini's son—and Lt.-Col. Biseo, flying a Service Marchetti S.79 three-engined bomber.

The new records, which improve on figures already held by Italian pilots, are unofficially given at 1,000 km., carrying 2,000 kg. at an average speed of 264.76 m.p.h. (423.618 km/hr.), and 1,000 km. at the same speed for machines carrying loads of 500 and 1,000 kg.

PRIVATE FLYING

"STYLING," as the Americans call decorative schemes, is a feature of the latest Fairchild 24, with 150 h.p. in-line Ranger engine. A luxury interior offers a choice of five upholstery colours, and fourteen colour combinations are available for the exterior. Cruising at 123 m.p.h., it carries three, and one of the well-established Warner-radial-engined models is available as a four-seater. Malcolm and Farquharson, of Heston, state that these machines may appear on the British market.

Topics of the Day

Thank You, Mr. Stephenson

AFTER all the thousands of words I've written about dead-reckoning navigation and the need for less of this Bradshaw-consciousness, I fell from grace quite sharply last Sunday while flying from Cardiff to Hatfield. For a quarter of an hour or thereabouts we followed every bend of the Great Western Railway and blessed the late Mr. G. Stephenson, while my passenger ticked off the stations like Mr. Claude Hulbert in the film of the Underground train which was being driven, if I remember correctly, by a madman.

By way of extenuation, I may say that I had a compass course on which to fly, that the railway line, generally speaking, closely approximated to this course and that the line was only being followed because it happened to have been laid out snugly in the lowest parts of the surrounding country.

Nor was this quite a case of "having a crack at it." Before we left Cardiff in a heavy drizzle and under a 450ft. ceiling, the airport's excellent teleprinter connection with the Bristol met station had provided us with a general forecast as well as actual reports from seven aerodromes lying on or near our proposed track. In my mind I had a clear picture of the general weather conditions, and of the probable developments, while there were suitable aerodromes dotted about for use in case of possible emergency.

The plan was to fly up the Severn, cross over by the tunnel (not through it) and reach Filton, which we knew to be safe, and make this a starting point for Cotswold investigations. If these were safety negotiable and the weather proved to be impossible on the other side I could either return to Filton or put down at a new Service aerodrome which was marked on my map at a convenient point. I knew that beyond Swindon we should be flying into better weather all the time—and so it proved. Four minutes after crossing that city of massed railway lines at 800ft. (above sea level—Cardiff) the ceiling went up to 2,000ft , the rain stopped and for the rest of the journey I could put my feet up on the dashboard.

All Experience

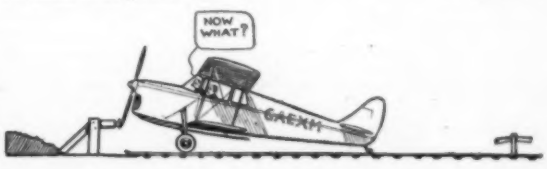
VARIOUS useful lessons were learnt and re-learnt during that trip, and I wouldn't have missed it for anything. One can set off in such conditions with reasonable confidence if plans have been made beforehand and if one is flying into known better weather towards an area where there is lots of room between the clouds and the ground. If by any awful chance the clouds had suddenly elected to sit firmly on the ground all around the machine, and if there had been no suitable fields immediately below, we could, as a last resort, have gone up through it all and attached the Hornet to a previously calculated compass course with a similarly calculated E.T.A. for the descent through the clouds. The whole of the eastern area had, on this occasion, a broken cloud base at 3,000ft., and it would have been impossible for the bad weather, even at 25 m.p.h., to have reached London before me. The risk is obvious with a single-engined machine, and for that reason we were prepared to stay underneath or, if possible, go back rather than climb through. That remained only as an emergency measure.

Which brings one again to the need for a turn indicator on all machines used for cross-countries, and the ability of the pilot to use such an instrument. Nobody but an idiot will use it unless he has to. A lightweight receiver for working on Borough Hill (1,176 m.) would also be a useful luxury. Up-to-the-minute reports can then be obtained while one is actually on the way.

As it happened on this occasion the wind was blowing from the south-west and the track was towards the east, so that the machine was flying crabwise over the ground in the convenient manner that gives one a perfect view through the open side window of any objects in the line of travel. It is never possible to see much through the screen itself, and that on the Hornet is rather a long way from one's eyes. My passenger received any draught that was going, but it is difficult to see how that can be avoided in any aeroplane.

All of which is by the way. The main fact is that I appear to have learnt quite a lot about what constitutes bad weather without noticeably endangering my own or my passenger's neck. And that is a good thing. Only recently a correspondent deplored the fact that he could learn only by experience, and demanded that full reports should be available of the causes of every major and minor flying accident. Very reasonably, he did not see why he should have to take the same risks, in the matter of discovering what one can or can't do, that have been taken by thousands of pioneer pilots.

INDICATOR.



FROM the CLUBS and SCHOOLS

LONDON

THE flying times for the week ended July 9 amounted to 141 hr. 50 min. New members are Messrs. H. Evans, W. Nielson, V. T. Usher, P. R. Tabor and G. E. Florman.

C.A.S.C.

Members will be on duty at Portsmouth Aerodrome next Saturday, July 17, for the Portsmouth Aero Club's Garden Party. Flying times for the week-end amounted to 6 hr. 30 min.

CAMBRIDGE

A great deal of blind flying has been done by members of Marshall's Flying School in preparation for "B" licence tests. Cross-country flights have been made to Nottingham, Bristol and Chepstow, contributing towards a week's total of more than 75 hours.

LEICESTER

During the month of June the Leicestershire Aero Club recorded thirty-five cross-country flights, visiting fifteen aerodromes, making a total of 90 hr. 30 min. flying. Two machines represented the Club at York Aerodrome for the International Meeting early in June.

SOUTH COAST

Just over 50 hours' flying was done by the South Coast Flying Club during the week ended July 11. Capt. MacGregor, Mr. Stevens and Mr. Furnival returned on Monday from the Belgian Aerial Tour, which they thoroughly enjoyed.

KENT

Twenty-nine aircraft from Southend, Wilmington, Brooklands, etc., attacked Canterbury at "dawn" on Sunday, July 11, twenty-three being, technically speaking, shot down. Messrs. Beckett and Bellsham-Revell have joined and commenced instruction, and Mrs. Duff has rejoined after her absence in Australia.

YAPTON

In spite of a high wind and bad flying weather, members spent over 53 hours in the air during the fortnight ended July 10. New members are Major E. Johnson and L. G. Hamlet. Miss L. Curtis has been successful in her "A" licence tests and Mr. L. F. Brightwell has made his first solo.

MIDLAND

Many cross-country flights have brought about a total flying time for the two weeks ended July 9 of 76 hr. 30 min. New flying members are Miss M. E. Ellison and Messrs. J. Duerdon, P. Milne-Milne, and H. G. Doody.

PENANG

Whilst H.M.S. *Berwick* was in port for three weeks, Lt. Andrews obtained his Straits Settlement "A" licence. Mr. W. O. Fiddes also qualified for his "A" licence. The flying times for May amounted to 103 hours, which included 28 hours solo. The cup presented to the Club by No. 36 (T.B.) Squadron is to be awarded to the winner of a blind-flying competition this year.

REDHILL

Flying times for the week ended July 9 amounted to over 93 hours. Of the machines that made an attack on Bekesbourne on Sunday, two were successful in getting through. Messrs. J. A. Barkel and J. A. von Glabbeek have now completed their "B" licence tests, whilst Messrs. A. Cudden Fletcher and W. A. O'Brien made their first solos.

YORK AND LEEMING

An order has now been placed for a championship squash court to be laid out at York and work will start on this as soon as possible. Various members have flown to Frankfurt to attend the International Rally, among these being Mr. and Mrs. Rowntree, Mr. and Mrs. Montieth, and Messrs. L. E. A. Foster, J. Dosser and Miler. New members for the week were Sqn. Ldrs. St. Leger and Evans-Evans. Flying times for the week ended July 10 amounted to 76 hours.

YORKSHIRE

Mr. John Morby, aged 99, made his first flight in the Yorkshire Aeroplane Club's Short Scion. The young enthusiast thoroughly enjoyed the experience and declared his intention of repeating it on his 100th birthday. Messrs. C. A. Bird and J. A. Smith passed their "A" licence tests. Over 71 hours were flown in Club aircraft during the week ended July 9, visits being made to Edinburgh, Lympne and Manchester.

SOUTHEND

A large increase has been shown in the flying times for last week as compared with the corresponding period in June. Five machines attended the Dawn Patrol at Bekesbourne, but no free breakfasts were obtained. Several new members have joined for flying instruction and three auxiliary Air Force units arrive this week for their annual training. Mr. Shea has completed his "A" licence tests and Mr. H. A. Dale has flown his first solo.

BORDER

During most adverse weather conditions at Carlisle, the Border Flying Club has managed to make a few cross-country flights—to the Isle of Man, Newcastle and Renfrew. Several members are arranging to spend their holidays touring the country in Club machines. Mr. Roddick has passed his "A" licence tests, while Mrs. Henderson and Messrs. Ruding-Bryan, Todd, and Macan have made their first solos. Six new members have joined.

WITNEY AND OXFORD

The Witney and Oxford Aero Club are holding their Garden Party next Sunday, July 18, when the new residential mess for the pupils of Witney Aeronautical College will be officially opened by Lord Sherborne. An attractive programme has been arranged, supported by machines from Auxiliary Squadrons. Flying times for the week ended July 3 amounted to 20 hours, of which 15 hours represented solo flying. Messrs. J. Errol Mansfield, E. D. Nicol, and B. T. O'Reilly have passed their "A" licence tests.

HANWORTH

New members of the London Air Park Flying Club are Messrs. Jude, Brady, Evans and Laywood, and first soloists were Messrs. Fitzsimmons and Gazda. Several cross-country flights were made during the week and the Club was well represented at the Brooklands evening patrol, although only one machine was successful in breaking through the defences. Mr. J. R. M. Sales has obtained his "A" licence. A total of 113 hr. 30 min. flying was recorded during the week ended July 10.

HAMPSHIRE

Club aircraft flew 232 hours during June and 72 hours during the week ended July 9. Night flying instruction was taken by Lady Hoare and Mr. E. A. Hood, the latter also passing his "B" licence tests at Hendon and making a successful night flight from Croydon to Southampton. Mr. N. A. Lawrence has qualified for his "B" licence. Three machines flew over *s.s. Ranpura* off Calshot as a send-off to Mr. and Mrs. Oakley, late of Jersey Airways, on their way to Misr Airwork.

BROOKLANDS

Half-yearly subscriptions are now available, which means that members joining forthwith have a subscription of only two guineas to pay, instead of four, for the remainder of the year.

On Sunday last, employees of the A.C. Sphinx Sparking Plug Company were entertained at Brooklands by Mr. Douglas Watson, several flights being made with F/O. Bremridge and Capt. Duncan Davis. New members to the Club are Count Zichy and Count Castelig, Sir John Piggott Brown, and Mr. Trilling. Mr. Orton passed his "B" licence tests and Messrs. Barnett and Denny made their first solos. Flying times for the week amounted to 120 hours.

A.S.T.

During June an interesting visit was made by the Parliamentary Air Committee, who lunched at the Air Service Training School. Among the distinguished company was Sir Alfred Beit, M.P., a former student of the school. A visit was also made by the Portsmouth branch of the Royal Aeronautical Society. Alterations and additions to the buildings are now taking definite shape and the administrative block has already evolved. A new club building, it is hoped, will be habitable before Christmas and extensions to the hangar are progressing favourably. Newcomers in June were Lord David Douglas-Hamilton, Mr. Jones of South Africa, and Messrs. Hudge and Hammond; whilst Flt. Lt. Milne and Mr. Burton came for the short course.

CINQUE PORTS

The Leopard and Puss Moth visited Frankfurt last week-end to attend the annual party, the machines being flown by Messrs. Carter and Hackney. Amongst recent visitors was an old friend—Mr. Hyman of Amsterdam, who has recently flown to the Dutch East Indies and back in his Leopard. Flying times for the week amounted to approximately 80 hours. Mr. Goodhew has now passed his tests for the instructor's licence and has returned to West Malling to take up his post. Mr. T. Hackney, who has been taking his "B" licence and instructor's ticket, has now successfully passed all his tests and taken up a position as third instructor to the Club. Mr. Hackney has not wasted much time as a year ago he did not even possess an "A" licence.

The Frankfurt Party

ON Friday more than eighty machines, including thirty-odd from this country, landed at Frankfurt for the international party organised by the Aero Club von Deutschland and by the Frankfurt Corporation, headed by Dr. Krebs, the Lord Mayor. The visitors were received by Herr Wolfgang von Gronau, the Club president, and by Lt.-Col. Hanesse, of the German Air Ministry.

(Above) Mr. G. O. Smith in one of the new King Kites. (Right) Mr. P. A. Wills in the Hjordis, with his brother Richard, who acted as interpreter, in attendance.

SOARING INTERNATIONALLY

A Member of the British Contingent Continues the Story of the Wasserkuppe Competition

THE first week of the International Soaring Competitions at the Wasserkuppe, in Central Germany, brought only three days of good soaring weather. Some flying, was, however, possible every day of the week, and, as a result of increased experience in flying from the site, the performance of the British team of pilots showed a steady improvement as compared with that of their competitors.

Mr. Wills's flight of 55 miles on the opening day, June 4, was mentioned in *Flight* last week. On this day eleven pilots got away on cross-country flights, while fourteen failed to find the necessary good thermal currents and landed again on the mountain side or down in the valley below. The furthest flights of the day were to Hamburg, three pilots reaching this city, 219 miles from the Wasserkuppe, and landing conveniently on the aerodrome. They were Heini Dittmar and Hanna Reitsch, of Germany, and Mynarski, of Poland. Fräulein Reitsch, who flew a brand-new machine with a high-speed range actually overtook Mr. Wills, who was on his way to Langensalza in the Hjordis, and lingered awhile in his vicinity, apparently trying to induce him to co-operate in the finding of thermals, to their mutual benefit, though unfortunately Mr. Wills did not realise her intentions at the time. He last saw her going rapidly eastwards although Hamburg is to the north. It appears that both Fräulein Reitsch and Herr Dittmar guessed that there would be little thermal activity over the plain to the north of Erfurt, upon which Mr. Wills was forced to land, and therefore worked their way round by the hilly country to the east of it before turning north again. Local knowledge certainly counts for a good deal in a soaring competition!

Among other distance flights on the same day were those of Hofmann (Germany), 174 miles; Zabski and Baranowski (Poland), 132 and 129 miles; Sandmeier (Switzerland), 127 miles; and Emi von Roretz (Austria), who went 121 miles and landed near Hamelin. Fräulein von Roretz has certainly improved out of all recognition since she used to fly at the London Gliding Club two years ago.

Monday, June 5, was a day of light northerly winds, insufficient for maintaining height over the north slope of the Wasserkuppe, so pilots glided out over the valley to look for thermals rising from the fields there. The British two-seater sailplane Falcon III proved itself particularly suitable for these conditions, owing to its low sinking rate when flown solo, and Flt. Lt. W. B. Murray and Mr. J. S. Fox, who flew it in turn, showed skill in picking up thermals within a few hundred feet of the ground and climbing in them almost to the base of the clouds which formed in their tops.

On Monday evening, and again on the following day, thundery conditions prevailed, but with very light winds. Several pilots got ready at the launching point in case the expected "cold fronts" should come within reach, and some were actually launched. But the "wedge" of cold air, which may provide soaring possibilities by lifting up the warm air in front of it, is apt to become irregular in mountainous districts such as the Rhön, and the area of "lift" is difficult to connect with, especially if there is insufficient wind to gain preliminary height by soaring over the slopes. The only pilot to make successful use of a "front" was Kurt Schmidt, flying his Atalante, which he designed and built and with which he won last year's National Soaring Competitions; he went about 9 miles.

The Unpopular Front

On Wednesday there was a "warm front," which was no use to anybody.

Thursday, July 8, brought a fairly strong west wind, and the "daily prize" was set for duration, the contest being confined to pilots who had not yet earned the international "Silver C" certificate. By a piece of smart team work the Falcon III was first to reach the launching point in the morning, and Flt. Lt. Murray got into the air before any of his competitors. If only the wind had maintained its strength, he would have automatically won the prize, since all times were reckoned only up to a quarter of an hour before sunset, after which pilots were obliged by the rules to land. However, a failing wind and the cessation of thermal activity let the pilots down one by one in the evening, the Falcon having to land after 5 hours 19 minutes in the air, while the Austrian pilot Frena, flying a Rhönsperber, won the prize with a duration of 6 hours 54 minutes.

Friday July 9, was an excellent day for distance flying, and the new King Kites had their first opportunity of showing their capabilities. The day was much like the previous Sunday, with a little wind up the west slope, but insufficient to save those who, after starting hopefully from the mountain top, were unable to find a thermal before they got down to the bottom, 2,000ft. below Some of the pilots, including those of the King Kites, after landing at the bottom, had their machines rapidly transported back to the top and were launched once more, to find the thermal currents so much improved that they were able to get up to the cloud base and go away on distance flights after all.

The greatest distances were achieved by the five pilots of

the German team, one of whom, Wolfgang Späte, flying a Minimoa sailplane, landed in Czechoslovakia after covering 176 miles. Sixth in order was the Swiss pilot Sandmaier, who went 90 miles. (This pilot, by the way, had achieved the longest distance—125 miles—among those who went on distance flights the previous day.) And seventh and eighth came two British pilots, Flt. Lt. P. M. Watt, in a King Kite, and P. A. Wills in the Hjordis. Mr. Wills flew 75 miles to Sondershausen, while Mr. Watt reached Jena and landed on a convenient aerodrome, after a flight of 78 miles. The aerodrome turned out to be occupied by a training school in connection with the German Air Force, and Flt. Lt. Watt was given a right royal reception. He was offered a good meal and then shown the sights of Jena, including the University and the Planetarium, and subsequently his hosts sat up with him till 2 o'clock in the morning waiting for the transport trailer to come and fetch him and his machine. As a final triumph, Flt. Lt. Watt found, on returning to headquarters, that he had won the special "daily prize," which for that day had been offered for height. He had, during the flight, climbed 7,644ft. above the previous lowest point, a feat which he performed by flying blind inside a large mass of cumulus cloud for an hour and a half!

Last Saturday, July 10, was one of those extraordinary days, occasionally met with at Wasserkuppe meetings, when one pilot gets well away and nobody else can do anything at all. The successful pilot was Heini Dittmar, flying the Sao Paulo sailplane (in which he set up a world's distance record on its first soaring flight three years ago). He left the Wasserkuppe in a west wind with little height to spare, reached another west-facing slope four miles away, and was gradually losing height there when a "cold front" came along and saved him. Having climbed high in this, within the clouds, he put up his speed to over 90 m.p.h. and left it for another "cold front" some way down wind, in which the rising current lifted him up again at a rate of as much as 33 feet per second. After similarly overtaking, and using, a third "front," Dittmar finally landed near Leipzig, having covered 110 miles.

At the end of the first week of the competitions it is of interest to add up the points so far gained by the various competitors, since it is on points that the principal prizes will be awarded.

Of the 32 competing pilots, only 19 have so far earned any points, since none can be earned for duration flights of less than 2½ hours, climbs of less than 500 metres, or distances of less than 30 kilometres.

The totals show that the first four places are held by Germans, Dittmar coming out top with 986, plus any more given for height when the barograph record of his last flight has been homologated. After him come Späte, Hanna Reitsch, Hofmann, Sandmeier (Swiss), Schmidt (German), Mynarski and Baranowski (Poles), and then P. M. Watt with 190 points, all gained on his flight to Jena. Zabski (Poland) and Emmi von Roretz (Austria) follow, then comes P. A. Wills with 154.5 points. Farther down the list is W. B. Murray, with 41.25 points, gained on his duration flight on Thursday.

The members of the Frankfurt Air Rally came up to the Wasserkuppe in force, by means of motor buses, on July 10, but unfortunately the weather was so bad that there was little for them to see before having to leave again. Another visitor, just arrived from England, is Mr. F. N. Slingsby, whose firm at Kirby Moorside, Yorks, have constructed, and in four cases designed, all the machines entered by the British team for these competitions. He was being flown up from Frankfurt by Mr. McMurdo in Major J. E. D. Shaw's Avro Cadet when thick weather forced them to make a hurried landing in a field at Fulda, unfortunately damaging the machine rather severely, but luckily without hurting either of its occupants.

A. E. S.

A King's Cup Reminder

PROSPECTIVE competitors in the King's Cup Race, to be held this year on September 10 and 11, are reminded that entries at ordinary fees must be received by the Royal Aero Club not later than July 19. Late entries at double fees will be received up till August 2.

Three Hundred at Zurich

AT the International Meeting, to be held at Dubendorf aerodrome, Zurich, between July 23 and August 1, there will be something like 300 competitors of almost every nationality. Details have already been given of the various competitions, and it would seem that the meeting is going to be a huge success.

R.Ae.C. Official Notice

ITALIAN August Aviation Meeting.—The Royal Aero Club has received particulars of the International Competition for Touring Aircraft to take place in Italy on August 22-29 next.

The competition is open to touring aircraft the total power of which is between 85 and 400 b.h.p. The entry fees are moderate and include hotel accommodation and exemption from landing and garage fees.

Full particulars may be obtained on application to the Royal Aero Club, 119, Piccadilly, London, W.1.

HAROLD E. PERRIN, *Secretary.*

BOOK REVIEWS

Flying Years. By C. H. Keith. (John Hamilton, Ltd., 18s.)

THERE is perhaps only one way in which a traveller—sojourner would be a better word—can give a really vivid, intimate picture of the land in which he finds himself, and that is by constant detailed writing of notes either as letters or in a diary. Sqn. Ldr. (now Wing Cdr.) Keith chose letters, and has published them in book form, for which action his readers owe him a deep debt of gratitude. He tells of Iraq, in which he was stationed from the autumn of 1926 to the autumn of 1929, following which he had five months in Egypt and Palestine. After reading his book one feels that one really knows something about Iraq and Palestine, and one wants to go and visit them.

There are, of course, many standpoints from which a visitor may describe life in an Eastern country. One writer may only deal with the life in the European clubs and, perhaps, the riding, shooting and fishing. A second may write only about his Service, and, when that Service happens to be the R.A.F., may fill his pages with technical details of flying. Yet a third may study the country and describe its present and its past. Wing Cdr. Keith takes all three points of view and mixes his subjects with just perfect discrimination. There is plenty of information about each of the subjects, and never too much about any one of them.

He had a very full life there, dodging and racing the storms over the mountains of Kurdistan, dining with Bedouin sheikhs in the desert, exploring the Persian Gulf and the Oman peninsula, now frozen with cold, now baked with heat, and always very thirsty. He got to know the varied peoples of the country, he studied its history and antiquities, and he also made No. 6 (Bomber) Squadron one of the most efficient units in the R.A.F. Very early in his stay he wrote: "Life is really very pleasant and full of interest. Why fellows funk coming to Iraq defeats me!"

It should be added that every now and again, but not too often, Wing Cdr. Keith gives a glimpse of his serious, robust, and cheerful ideas on religion and philosophy. Altogether, it would be hard to praise this book too highly. It is almost unique, and very, very interesting.

Air Over Eden. By "HW" and Sidney Hay. (Hutchinson and Co., Ltd., 18s.).

BOOKS about Iraq are always welcome, and lately we have had two very good ones in *Euphrates Exile*, by A. D. Macdonald, and *Flying Years*, which is reviewed above. *Air Over Eden*, by "HW" (presumably Wing Commander Howard-Williams, M.C., Inspector, Iraq Air Force) and Miss Hay is more ambitious and perhaps less successful. The foreword is written by the late General Ja'far al Askeri, and he gives the book high praise. It is, in fact, full of merits and attractions, and yet there is something disjointed about it which debars it from being given first place. This jerky, disjointed style is particularly noticeable in the chapters which profess to give the history of the country, but which leave the reader more confused than instructed. Later on there are chapters about various sides of life in Iraq, and some of them make good reading, though all through one wonders if the book is a treatise on the country, a record of personal experiences, or an assertion of the advantages of using aircraft. The illustrations from photographs are very good.

HURRYING to WALES

RECIPROCITY: Mr. Henshaw, the second man home, swings Mr. G. de Havilland's T.K. airscrew before the start at Heston, and Mr. G. de Havilland, the winner, does the handshaking act with Mr. Henshaw (in the Mew Gull) for the newspaper photographers' benefit at Cardiff. (*Flight* photographs.)

The Seventh London-Cardiff Race Won by the T.K.2 for the Second Year in Succession : A Head Wind Reduces Averages

THOSE more obstinate souls who will never see that fast machines (because they are suffering for a shorter period) are proportionately less affected by a strong wind over any racing course which is not of the one down-wind leg variety may obtain some unconvincing proof from the results of this year's London-Cardiff race. With minor exceptions the finishing order of the nine starters was in terms of plain speed. Actually, the fastest machine, Henshaw's Mew Gull, came in six seconds after G. de Havilland's T.K.2; the Western Airways D.H. Rapide, entered by R. Cadman, and flown by D. R. Cubitt, was two places lower than it should have been on this reckoning; and the slowest machine, Col. Strange's Spartan Arrow, was not quite last.

However, the proof in this case is unconvincing because Messrs. Dancy and Rowarth naturally allowed for the fact that the Arrow, for instance, would be doing battle for an hour and a half at a ground speed of less than 80 m.p.h., while the Mew would be doing its reduced ground speed for a matter of forty minutes or less. If rumour is to be believed, the handicappers expected the Swallow and the Spartan to win if their perennial hopes for a line-abreast finish did not materialise; in fact, there was an interval of seven minutes between the first and last men—which cannot be considered as bad going over a 120-mile course.

The real reasons for the particular winning order were probably multiple. The wind speed may have been a little higher than was actually forecast, and one or two pilots went rather off their course. Most important of all, the bumps at racing (or tree-top) level were shattering enough to reduce the speed of all the machines to some extent, and that of the slower machines particularly. In fact, it would probably have paid the pilots of these machines to have flown a little higher, though it was necessary to go up to 2,000 feet to be completely free from violent disturbances.

Cruising gently to Cardiff at this height in a D.H. Hornet at a corrected air speed of 105 m.p.h., our ground speed worked out at 80 m.p.h. The track in this case was some 30 deg. out of wind, while the competitors, who were flying from Heston to the Beachley Point turn, were flying almost, if not quite, directly into wind. It would probably be fair, therefore, allowing also for ground bumps, to add 20 m.p.h. to all the speeds given in the table in order to obtain the true cruising speeds of the machines in the race. In one or two cases a little more can be added with fairness; Godfrey's Swallow, for instance, was so badly bucked about that the pilot, Bay, could not hold an accurate compass course and he went rather far north of his track.

From the point of spectacularity alone it was a pity that Gardner's Mew Gull, which, with its Series II Six and v.p. airscrew, appears to be quite a lot faster than Henshaw's, elected to suffer from minor undercarriage trouble and had to be scratched. Otherwise we might, with the handicapper's help, have seen the two Mews and the T.K. screaming over the line in a solid phalanx.

Wet Sunday in Wales

After a morning of intermittent thunder showers things cleared up for the race, and from our 2,000 ft. eyrie the country could be seen for about thirty miles in all directions. By way of showing us all what summer can be, Sunday turned up at Cardiff as a real horror, with fine rain and a cloud base at 500 ft. or less—conditions which spread eastwards as the day wore on. Those competitors who hurried back in the morning were the lucky ones; leaving Cardiff at about 2 p.m., we just managed to scrape back with the Hornet in reasonable safety, knowing that we were flying towards better weather. Apparently the portcullis slammed on the Cotswolds less than an hour later.

The prizes were duly presented on Saturday afternoon by Mrs. Charles Keen, the wife of the Cardiff Club's chairman, and the evening's party terminated (judging from noises off) at 4 a.m. or thereabouts.

LONDON-CARDIFF AIR RACE RESULTS.

Machine.	Pilot.	Starting Time.	Finishing Time.	Speed.
		hr. min. sec.	hr. min. sec.	m.p.h.
1. T.K.2 ..	G. de Havilland.	2 45 48	3 30 24	161.4
2. Mew Gull ..	A. Henshaw ..	2 55 19	3 30 30	204.6
3. Miles Falcon ..	J. C. V. K. Watson	2 44 05	3 32 38	148.3
4. B.A. Eagle ..	R. P. G. Williams	2 35 39	3 33 43	124.4
5. B.A. Eagle ..	H. F. Broadbent	2 31 09	3 34 03	114.5
6. D.H. Rapide ..	D. R. Cubitt ..	2 38 47	3 35 28	127.0
7. D.H. Hornet ..	C. W. Wrightson	2 24 02	3 36 05	99.9
8. Spartan Arrow	L. A. Strange ..	2 02 00	3 37 43	75.2
9. B.A. Swallow .	D. M. Bay ..	2 04 08	3 37 58	76.7

Prizes:

Silver Cup, presented by N. W. Nash, Esq., and £50 to G. de Havilland. Silver Cup, presented by R. K. Wellsteed, Esq., and £20 to A. Henshaw. Cash prize of £10 to Germ Lubricants (J. C. V. K. Watson). Silver Cup and £15 for fastest time to A. Henshaw.

HERE and THERE

A "Smithy" Memory : Hanworth Appointment : D.H. Progress : Industrial X-Rays

Resourcefulness Recognised

AFTER two years, Capt. P. G. Taylor, the late Sir Charles Kingsford Smith's navigator, has been awarded the O.B.E. in recognition of resourcefulness and courage of a very high order.

In 1935, Kingsford Smith and Taylor were flying Jubilee mails from Australia to New Zealand in *The Southern Cross*. When about 600 miles out over the Tasman Sea, engine trouble developed when one motor was already out of action. With the machine losing height, Taylor climbed out along the wing and transferred oil from the "dead" engine to the one showing signs of failing.

The Southern Cross was able to struggle back to Sydney after six such transfusions had kept her in the air for nine hours.

Capt. Taylor told in vivid detail the story of one of his flights with Kingsford Smith in a recently published book, *Pacific Flight*.

Air Comdre. Bigsworth for General Aircraft

IT is announced that Air Commodore A. W. Bigsworth, C.M.G., D.S.O., A.F.C., R.A.F. (Rtd.), has joined General Aircraft at Hanworth.

Air Commodore Bigsworth entered the Royal Navy in 1909 and was among the first ten naval officers who took up flying in 1912. On May 17, 1915, he was stationed at Dunkirk, holding the rank of Flight Commander. When the Zeppelin L.Z.39 passed overhead Bigsworth, in an Avro 504 seaplane, climbed above it and chased it to Ostend, where he dropped four 20 lb. bombs successively along its back. The airship made her shed at Evere with one dead officer and several wounded men in the gondola, the starboard aft propeller gone, and five gasbags damaged. Air Commodore Bigsworth is also said to have been the first airman who destroyed a submarine with bombs.

Rising in the R.A.F. after the war, he was Director of Equipment at the Air Ministry from 1931 until he retired in 1935.

D.H. and Big Figures

A RESOLUTION to increase the company's capital to £1,200,000 was carried unanimously at an extraordinary general meeting of De Havilland shareholders last Monday.

The Chairman (Mr. T. P. Mills, in the absence of Mr. A. S. Butler) said that the company had nearly £4,000,000 worth of work on hand—enough to keep aircraft, engine and airscrew divisions fully occupied for a very considerable time.

"It is obvious," said Mr. Mills, "that immense developments will continue to take place in air transport and that the scope for aviation in this direction is as great as, if not greater than, its war-like applications."

He stressed that the company's growth had been on the simplest lines, there never having been, for example, any debentures, preference shares, bonds or notes of any kind. He recalled that of the present seven directors, no fewer than five were the original five mainly interested in the present company's formation in 1920, when the capital was £50,000.

The Analytical Eye

AN application of X-rays of particular interest to the aeronautical industry is that of examination of light alloy parts, either photographically or by direct vision. Interior casting and working defects, such as blow-holes, immediately become visible, and the test-piece is not destroyed.

Commercial X-Rays, Ltd., who for over thirteen years have run a mobile X-ray medical service, have now started a new service for engineers who need reports upon metal parts of all descriptions. The examination is inexpensive and takes a matter of hours only. The time must come when all large engineering concerns, particularly in the aeronautical world, will have either their own apparatus (which Commercial X-Rays can supply) or, depending upon the nature and amount of work, an outside inspection arrangement such as that described. The firm's laboratories are at Power Road, Chiswick, London, W.4.

TESTIMONY TO TOUGHNESS. This aircraft piston, made of RR59 "Hiduminium," one of the group of nickel-aluminium alloys produced by High-Duty Alloys, Ltd., of Slough, tells the tale of a broken valve. The valve hammered the crown for half an hour while the pilot sought a landing place. In spite of the fact that craters 2in. deep were formed, the crown did not collapse.

Geodetic Overloading

READERS may have been puzzled by the gross weight figures for the Vickers Wellesley published in *Flight* last week, which gave the normal gross weight as 10,900 lb. and the overload gross weight as 10,500 lb. The latter figure was a printers' error and should have read 12,500 lb.

Blackburn's Year

THAT the original Leeds factory had been re-opened and was already materially relieving the pressure at the Blackburn Company's main factory at Brough was reported at the annual general meeting held last week. The chairman, Mr. Robert Blackburn, said that the year's profit of £120,480 reflected a very large increase in business, and with the completion of the Leeds factory and that on the Clyde, operated in conjunction with William Denny and Bros., Ltd., further substantial increases in output could be anticipated.

Mr. Blackburn remarked that under the agreements which were in force between the industry as a whole and the Air Ministry, profits were strictly limited to a reasonable percentage of turnover. He wished to emphasise that point, as he believed that a great deal of harm had been done to the industry by the popular idea that aircraft companies were making unreasonable profits out of the expansion programme.

Expansion Extraordinary

ONLY twelve months ago the firm of Northern Aircraft and Engineering Products, Ltd., started work with a capital of £300. To-day they have orders on their books to the value of tens of thousands of pounds, are employing nearly 200 men, and can show a year's turnover of £9,000.

The nature of the work at present in hand is the manufacture of sheet metal fairings and cowlings, and among the larger jobs are Armstrong Whitworth Whitley engine cowlings and Ensign fairing rings. The Fairey Battle, Blackburn Shark and Airspeed Oxford utilise many parts made by this company, such as bomb doors, instrument mountings and fairings.

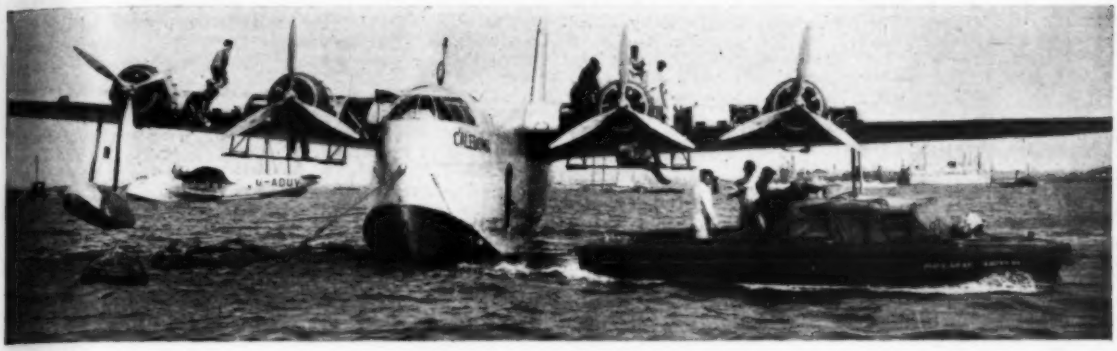
Seats and boxes for the Avro Ansons are further products, and large orders for cadmium plating and anodic treatment are being undertaken.

The works are at Jordan Street, Knott Mill, Manchester, 15.

Piston Multiplicity

ALMOST ambitious catalogue of Hepolite pistons, rings and liners has been produced by Hepworth and Grandage, Ltd., St. John's Works, Bradford. Until one sees such a list it is scarcely possible to credit that a single firm can offer so many slightly differing products.

COMMERCIAL AVIATION



THE WEEK AT CROYDON

Oxygen as Red-hot News : Syncopation—in Scandinavia and Brixton : Speed and Comfort

FUN was had by all last week when the Air Ministry issued a *Notice to Airmen* about the use of oxygen when flying high. Fleet Street had never heard of it, apparently, except for reviving the presumably drowned, and phones at Croydon went tinkle-tinkle. One very solemn journal decided that, as most British aircraft don't use the stuff, the whole thing was something for "sub-stratosphere flying in the fairly remote future," but had it confidentially from "an official" that it was only a matter of putting oxygen cylinders by each passenger's chair. Actually, it is nothing so primitive, for many machines of types coming in and out of Croydon all day and every day are properly and scientifically equipped with oxygen plant. Various European firms which fly the Alps have their aeroplanes so fitted—D.L.H.. A.L.I. (Italian). Swissair and K.L.M., and the last-named company has its Amsterdam-Batavia machines thus equipped, so that comfortable and fast flying can be done at the most efficient heights. The Douglas machines I have seen have the cylinders in the rear luggage compartment, and the cabin is fed through the hollow chromium-plated rail of the luggage net. From this depend a number of flexible pipes like speaking tubes, one for each passenger. Press button B to get oxygen; release it, and the flow stops. Swissair and K.L.M. stewards or stewardesses are fully trained in this respect, and the crew in the cockpits have their own supply of oxygen. That is the quite interesting story the newspaper might have told instead of giving the impression that this was some Wellsian dream of the future.

Moscow—London

Another paper was all worked up because a Mr. de Lown flew from Moscow to London in a day by the regular Aeroflot-A.B. Aerotransport route to Stockholm, thence to Amsterdam and on to Croydon by Scandinavian Air Express K.L.M./A.B.A. They said he was the first Moscow-London passenger to do it in one day. Not he.

Exceptionally interesting, as showing how much individual service and attention counts in air travel, were two passengers last week. One was a blind man who travelled by British Airways from the Continent unaccompanied, and the other was a girl of twelve who came from Cologne by Imperial Airways alone, lunched with great composure at the Aerodrome Hotel, and then went on by Railway Air Services to Belfast, making the whole trip without the least trouble, worry or embarrassment.

Air France last week had a cargo of platinum ore *via* Marseilles from Asmara, Abyssinia; I can think of several comments on this bit of news, but, like Brer Rabbit, I'm lying low and saying nothing.

The Alake of Abeokuta came in from Paris by Imperial Airways, complete again with gold-knobbed golfing umbrella supported by a gigantic gentleman in ruby-coloured velvet robes. Some of his subjects, who met him after a smart shower of rain, knelt down on the tarmac as he disemplaned. Moral for air liner captains and commanders whose crews get a bit up-stage: Get a brolly with gold knobs on and bring them to their knees.

Potentates of the boxing ring also arrived at Croydon last week. Max Schmeling, welcomed by his lawyer and Jim Howells, came in by D.L.H. from Berlin, and, the same day, Jeff Dickson flew over from Paris. Nat Gonella and his band also arrived, having been enabled, thanks to the Scandinavian Air Express, to give three performances in Stockholm one day, take the night train to Malmö, fly to England (arriving at 2.40 p.m.) and give a show in Brixton on the evening of arrival. If you like Mr. Gonella's sort of music, this is one of the immense boons air transport has conferred on the world; if you don't, it is one of the curses of swift travel in this restless age of ours.

Swissair, whose passenger lists certainly warrant the employment of larger aircraft, had the first of their Douglas D.C.3 machines in to Croydon during the week. Pilots are delighted with the machine, which (say the experts) has many advantages over the D.C.2 from a pilot's angle.

Lastly, heartiest congratulations from all Croydon friends to Capt. Wilcockson, First Officer Bowes and the rest of the *Caledonia's* crew!

A. VIATOR.

Imperial Oddments

OWING to the fact that *Canopus* and her sister craft have taken over the African services, the activity of the five Hannibals stationed at Alexandria is confined to the comparatively easy task of flying between Karachi and Alexandria (2,572 miles), twice weekly in each direction. Incidentally, eight of the "C" class boats have now flown to Durban; no special boats appear to have been alloted to this route, and probably all boats based at Southampton will have a turn.

Amalthea, *Astraea* and *Andromeda*, relieved of their Kisumu-Johannesburg duties, appear to have been taken over by Wilson Airways and are flying between Kisumu and Salisbury.

When *Hengist* was destroyed by fire on May 31 *Artemis*, which had left Singapore on May 29 to connect with her at Karachi, had to fly on to Alexandria, return on the day after arrival and be back at Singapore on June 10. She arrived on time, having covered over 12,000 miles in twelve days.

During the last three months there have been 100 Imperial and Qantas arrivals at Southampton, Durban, Johannesburg and Brisbane, and all but ten of these have been on time.

Commercial Aviation

NORWEGIAN INAUGURATION

Allied Airways Makes a Start with the Newcastle-Stavanger Service

THE new Tyne-Norway air service, sponsored by Allied Airways (Gandar Dower), Ltd., was given a good send-off from Woolsington Airport on Monday when the D.H.86B, *The Norseman*, was christened by the Lady Mayoress of Newcastle (Mrs. John Grantham), who was one of the passengers on the inaugural flight. The machine, piloted by Eric Starling, made the outward and return flight to schedule, although weather conditions were anything but good.

Mr. E. Gandar Dower seized the opportunity of the inaugural ceremony to get in a blow on behalf of civil aviation and to say to Lt. Col. Sir Francis Shelmerdine, Director General of Civil Aviation, who came up specially to give the new service his blessing, that he held the future of British civil aviation in his hands. "Civil aviation is at the moment a very difficult and struggling child," he said, "I doubt if many air lines in this country are becoming very prosperous in the work they are doing, and I do think some form of Government support should be forthcoming. Most of the other countries are lending a hand, in the form of subsidies, to their air lines, and I think Great Britain must have a right view of this point. It is recognised that a strong mercantile marine is necessary to back up the Royal Navy in time of struggle and I suggest that a great air marine would be a great backing to the Royal Air Force in similar circumstances. A subsidy can be given by the removal of the petrol tax, for it is hard to see why we should be paying this tax when we are not using the roads."

Sir Francis, in his reply, said that the new service was another step forward in British aviation. Unsubsidised air lines required no mean courage and initiative, and he wanted to congratulate Mr. Gandar Dower on his enterprise. He pointed out that the D.H.86B was the same type which operated on the Empire service between Singapore and Australia, flying over the Timor Sea. "This service owes its possibility to this aerodrome, which was opened by Lord Swinton," he said. "It is an outstanding instance of the foresight of the municipal authorities because here you see an airport constructed in a time of deep depression and now reaping some of the benefit."

Passengers on the first flight were the Lady Mayoress, Alderman E. Gibbin (chairman of Newcastle Airport Committee), Mr. Gandar Dower, Mr. R. S. Bisset (Aberdeen), Captain J. D. Irving (chairman of Newcastle Aero Club) and Commander Ruser Larsen (Norway). On the return flight *The Norseman* brought the Norwegian mail—weighing 12 lb.—which was accompanied by Mr. E. M. Erichsen, the postmaster of Stavanger.

The fact that the service was not to carry the mails from this side had, it appears, caused considerable surprise among Norwegian officials, who were unable to understand why no tangible help was being given by the British Government to a new service about which the whole of Norway was most enthusiastic. Capt. Irving, who described the flight as being "simple and uneventful," was full of praise of the airport at Stavanger, which was made possible by a 60 per cent. Government subsidy.

At night the Lord Mayor of Newcastle (Alderman John Grantham) entertained those associated with the new service to dinner in the Mansion House, Newcastle, when the question of Government support was again voiced.

Things to Come

A *NOTICE to Aircraft Owners* explains that an addition will shortly be made to A.M.D. 13 to provide for the high altitude operation of passenger machines. In due course it will be necessary for all machines on which flights at an altitude of 15,000ft. or more are made to carry a supply of oxygen with suitable apparatus for the use thereof. Not yet awhile in this country, but oxygen is already being carried on American transports and on machines crossing the Alps.

Supply and Demand

SOME idea of the trend of transport flying requirements can be gathered from the way in which the number of Second Class Navigators' Licence examinees has increased during the past year or so. Working at, or in correspondence with, the Imperial School of Navigation, for instance, are something very like a hundred students.

This school, as already announced, has recently moved to new and larger quarters, with two main lecture rooms and restaurant facilities. Assisting Mr. C. W. Martin, the principal, is Capt. W. E. B. Griffiths, who is a Gold Medallist Extra Master, and in September it is probable that a First Class Licence course will be started. Such significant items as bubble sextants and star globes can already be seen about the place.

Trans-Canada

IT was recently announced in Montreal that Mr. Philip G. Johnson had been appointed vice-president of Trans-Canada Air Lines. He will be in charge of operations of the new system. Mr. Johnson has been connected with air transport for the past ten years and was responsible for the organisation of United Air Lines' services. He entered the service of the Boeing Company at Seattle during the war period, served as vice-president, general manager and president of this company, and later as president of United Air Lines.

Mr. Johnson began his work in Canada this month by making an examination of the facilities over the whole trans-Canadian route in the Department of Transport Lockheed Electra, accompanied by Sqdn. Ldr. J. H. Tudhope and others.

Another Atlantic Project?

IT is reported that the American Export Line—which operates a cargo and passenger shipping service between New York and the Mediterranean ports—is planning a transatlantic service to compete with the Pan-American and Imperial Airways Service. Application, apparently, has been made to several Mediterranean Governments for permission to conduct survey flights. The proposed route runs *via* Bermuda and the Azores, to Spain, Portugal, Marseilles, Naples, Jaffa, Alexandria, Haifa and Beirut.

If the report is a true one, it can only be said that the appearance of private enterprise in such an expensive field of operations is surely a healthy sign. The majority of people are under the impression that such service developments can only be fostered with the help of enormous Government support.

Germany's Atlantic . . . .

D.L.H. have obtained permission to make eight experimental return crossings of the Atlantic between Port Washington, New York, and Frankfurt-on-Main, via the Azores and Lisbon. The first flight was scheduled to start yesterday, July 14, and two catapult ships, presumably the new *Friesenland* and the *Ostmark*, are waiting off Azores and the North American coast to aid the Blohm and Voss four-diesel-engined seaplanes which, we understand, are to be used. All of which is extremely interesting as a development running parallel, so to speak, with our own Mayo composite and possible refuelling experiments. The floating island idea is far from dead and may yet provide the ultimate solution to "payload" Atlantic crossings.

. . . . And France's

M. PIERRE COT, French Air Minister, has informed the Chamber of Deputies that he has given orders for work to be started on a new flying boat which will be capable of being used on the North as well as the South Atlantic services of Air France. This boat is the Lioré et Olivier 49 which, while possessing many new features, is derived from the Mediterranean flying boat LeO 24 and the LeO 47.

She will carry forty passengers on the present weekly service between Dakar (West Africa) and Natal (Brazil) at 200 m.p.h., with mail and freight to a weight of 4,400 lb. She will make the crossing in ten hours. When carrying a total payload (consisting of passengers, freight and mail) of 11,000 lb. weight she will cruise at the same speed for twenty hours non-stop. This gives ample margin for the North Atlantic crossing, which requires a clear range of 2,500 miles.

The fact that work—which may take two years to complete—is starting on this machine shows that France is planning well in advance.

SCANDINAVIAN ADDITIONS

The New Moscow-Stockholm Service : Ju. 90 for D.L.H.'s Norwegian Run

OPENED on July 1 the Kremlin Air Express is now in regular operation. The service, Stockholm-Riga-Moscow, which forms a new air link between Soviet Russia and Western Europe, is operated jointly by the Swedish A.B. Aerotransport and Aeroflot. The Swedes are using Douglases, while Aeroflot have introduced their newest design, the A.N.T.35, which cruises at about 190 m.p.h. and carries twenty-five passengers. The trip is done in about seven hours and the fare between Stockholm and Moscow is about £11 16s. The westbound machine arrives in Stockholm in good time to connect with the London and Paris machines leaving at 1 p.m. In addition to this service, a number of other new Baltic and Scandinavian lines have recently been opened. D.N.L., for instance, have opened a new line Bergen-Oslo-Gothenburg-Copenhagen with daily departures from Copenhagen at 8.15 a.m. and daily arrivals at 9 p.m.

It is reported that D.L.H. have applied to the Norwegian Government for a concession to operate a new direct line from Oslo to Berlin, using the new forty-seater four-diesel-engined Junkers. D.L.H. will probably start this new service next year when the Fornebo airport is completed. The Polish L.O.T. company is also understood to be negotiating with the Danish authorities concerning a direct line between Copenhagen and Warsaw for next year. Finally, the Estonian air transport company will collaborate with the Finnish Aero in operating a new service Helsingfors-Reval (Tallinn), also starting next year. The Estonians intend to purchase a D.H. Rapide for the purpose, but the service will initially be operated by means of Avro Ansons temporarily hired from the Estonian Air Force.

The considerable expansion of Scandinavian and Baltic Air services which is taking place or is being planned involves the planning of more national feeder lines, and such are forthcoming. In Denmark the first national service has been opened between Copenhagen and Aalborg, and an extension is being planned beyond Aalborg to Gothenburg, Sweden. Another service between Copenhagen and Esbjerg will be started on July 18 in connection with the opening of the new Esbjerg airport. A third line will be opened between Copenhagen and Aarhus, the principal city of Jutland, and a fourth will be opened next year between Copenhagen and Ronne, the capital city of the isle of Bornholm. Lastly, a feeder line from Esbjerg to connect with the German air transport system at Flensburg is being contemplated.

In Norway, a feeder line has been opened between Oslo and Bergen connecting with the Oslo-Copenhagen service. A concession has further been granted to Wideroes Flyveselskap to start and operate two new lines Oslo-Arendal and Oslo Trondheim-Bodo, the later service being maintained for about one month only (July 3-August 2). Last, but not least, Oslo is being linked up with the Aberdeen-Stavanger North Sea service.

Supported by municipal authorities, the Finnish company, Aero, has started the experimental daily operation of two feeder lines, Helsingfors-Viborg and Helsingfors-Tammerfors, and further national services may be forthcoming soon.

Belfast Regulations

ON July 28, between midnight and midnight, no machines may fly within an area enclosed within a circle of six-miles radius from the City Hall, Belfast, within a five-mile radius of the Town Hall, Lisburn, or within a five-mile radius of Government House, Hillsborough. The occasion is the Royal visit to this area, when processions will be in progress and a large number of people will be about.

New Canadian Link

A NEW service linking Boston and five other New England cities daily with Montreal was established by Central Vermont-Boston-Maine Airways on July 1. This new run will be an extension of the present line of this company, which is a railway subsidiary. The flying time between Boston and Montreal will be from two hours to two hours 10 minutes, Lockheed Electras being used.

Bits and Pieces

FOR some reason or other the bits and pieces of aeroplanes —even those accessories which have little or nothing to do with the process of aviating as such—are almost as interesting as the aeroplanes themselves. With the ever-watchful A.I.D. about, these pieces are certainly as well made and as good to look upon as the structural bits.

During the last few months a new sub-contract firm, R. Malcolm, Ltd., have been getting down to things on the Slough Trading Estate, and are already working hard on a number of very fair orders for well-known aircraft manufacturers. Incidentally, the spy-minded individual can always obtain a good idea of the number of ——s (very secret; even the name must not be breathed) on order by counting the number of fuel tanks or what-not being made at different works.

Mr. Malcolm is, of course, also of Malcolm and Farquharson, Heston Airport, and he has with him, as works manager, one G. Rixon, who has had long experience in the sheet metal business. Certainly the results, both in this and in the fitting shop, show what can be done, even in a comparatively small (6,000 sq. ft.) works, with proper equipment and organisation. The latter is very necessary nowadays, if only to prevent newcomers from putting their fingers in the harmless-looking annealing tank—300 deg. C., and all that.

De Havilland C.P. Airscrew Data

SOME data on De Havilland c.p. airscrews, recently issued, may be found useful for reference purposes. All these airscrews operate on the constant-speed principle when fitted to engines which are designed to take the D.H. constant-speed governor unit. Alternatively, the airscrews of 9 deg. to 15 deg. pitch range may be operated as two-pitch airscrews with normal engine oil pressures; airscrews of 20 deg. pitch range may be operated as two-pitch airscrews when high pressure oil supply is available. The basic pitch setting may be varied by changing the position of the index pins. Any of the pitch ranges listed below may be restricted if required by adjusting the pitch-setting stops located within the counterweights.

1,000 size.—Right or left-hand (viewed from slip stream). Two-bladed. For engines up to 250 h.p. (253 c.v.). Diameter up to 7ft. 6in. (2.29 m.). Weight depending upon diameter, up to 70lb. (31.8 kg.). Pitch range 9 deg. or 14 deg.

2,000 size.—Left-handed. Two-bladed. For engines up to about 375 h.p. (380 c.v.). Diameter up to 9ft. (2.74 m.). Weight up to 110lb. (49.9 kg.). Pitch range 14 deg.

3,000 size.—Left-handed. Three-bladed. For engines up to about 550 h.p. (558 c.v.). Diameter up to 9ft. 6in. (2.90 m.). Weight up to 175lb. (79.4 k.g.). Pitch range 15 deg. This size is not at present in production.

4,000 size (two-bladed).—Left-handed. For engines up to about 550 h.p. (558 c.v.). Diameter up to 10ft. 9in. (3.28 m.). Weight up to 180lb. (81.6 kg.). Pitch range 15 deg.

4,000 size (three-bladed).—Right or left-handed. For engines up to about 850 h.p. (861 c.v.). Diameter up to 10ft. 9in. (3.28 m.). Weight up to 266lb. (120.6 kg.). Pitch range 10 deg. or 20 deg. (20 deg. model weighs 6lb. (2.7 kg.) more than 10 deg. model).

5,000 size.—Right- or left-handed. Three-bladed. For engines up to about 1,000 h.p. (1,014 c.v.). Diameter up to 13ft. (3.96 m.). Weight up to 360lb. (163 kg.). Pitch range 10 deg. or 20 deg. Weight of 20 deg. model is 8lb. (3.6 kg.) more than 10 deg. model.

6,000 size.—Left-handed. Three-bladed. For engines up to about 1,700 h.p. (1,723 c.v.). Diameter 14ft. 6in. (4.42 m.). Weight up to about 525lb. (238 kg.). Pitch range 20 deg.

EXIDE'S LATEST aircraft battery, which has a very high capacity-weight ratio. It was described on page 23 of *Flight* of July 1

THE INDUSTRY

News of Recent Developments : New Companies : Patents

HAWKER AND HAWKS: A smart line-up of R.A.F. Hillman Hawk service cars seen at the Hendon Display.

On Hand

FOR filing B.O.C. Technical Booklets, the British Oxygen Company (Thames House, London, S.W.1) supply on request a serviceable patent Napierian rod binder, attractively finished in maroon and gold.

Camera Manufacturers' Results

AT the annual general meeting of the Williamson Manufacturing Co., Ltd. (the manufacturers of "Eagle" aircraft cameras), a net profit for the year of £27,427 was reported. A final dividend of 10 per cent., actual, less tax, was recommended.

"Elektron"

MAGNESIUM ELEKTRON, LTD., of Abbey House, Baker Street, London, N.W.1, remind those whom it may concern that the name "Elektron" is their registered trade mark, used in respect of the magnesium-base alloys made by them and sold by F. A. Hughes and Co., Ltd., as sole concessionaires in this country.

Howard Hughes' World Flight

ORGANISATION has been completed to the last detail for the projected round-the-world flight by Mr. Howard Hughes. Agents at every possible stopping place have been instructed to prepare supplies of petrol and oil, and the world-wide Exide organisation has been given the task of ensuring that spare batteries will be ready if required. Arrangements have already been made between the Exide Company in England and their Paris branch to have two Exide batteries waiting at Le Bourget airport, fully charged and ready for use.

Airscrew Progress

AT the beginning of the 1936-37 working year of the Airscrew Co., Ltd., the hope was expressed that the output would be more than double that of the previous year. At last week's annual general meeting, the chairman, Mr. J. D. Titler, said that that hope had been realised and, in fact, the turnover for the past year had been rather more than two-and-a-half times that of the previous year. The profit amounted to £40,200.

The chairman described at some length the very considerable development of detachable wooden airscrew blades under the patent process acquired by the company, and said that the matter of producing a v.p. hub was under consideration. The manufacture of compressed wood by the Samsonow process was now being arranged at the Weybridge works, and it was hoped to begin production before the end of the year.

NEW COMPANIES

In the notes below, for reasons of space, the "objects" of new companies are usually somewhat abbreviated.

THE AIRCRAFT OPERATING CO., LTD., was registered as a private Company on June 21, with a nominal capital of £100 in 100 shares of £1. Objects: To secure and carry out contracts in any part of the world for air surveys, for the management, operation or agency work for air lines and for the carrying of passengers, freight, etc. The first directors are to be appointed by the subscribers. Solicitors: Stoneham & Sons, 108a, Cannon St., London, E.C.4.

DANN'S CONTROLLED RAYS SYNDICATE LTD. Private company. Registered June 22. Capital, £100 in 100 shares of £1 each. Objects: To carry on the business of manufacturers of and dealers in anti-dazzle scientific instruments and appliances for motor car headlamps, aircraft, aerodromes, film studios, street and allied lighting, etc. The directors are: Wm. C. Houghton, 18, Harcourt Terrace, London, S.W.10., Cardigan B. Dann, Rivermead, Thames Street, Sunbury-on-Thames.

IMPERIAL AIRWAYS (REPAIR WORKS) LTD., was registered as a private company on July 1 with a nominal capital of £10,000 in 10,000 shares of £1 each. The objects are to carry on the business of repairing, maintaining, and converting aircraft and engines of all kinds, and all component parts thereof, manufacturers of and dealers in aircraft. The company is to be and remain under British control. The first directors are to be appointed by the subscribers. Registered office: Airway Terminus, Victoria Station, London, S.W.1.

AIR-FALC LTD.—Private company registered June 30. Capital, £500 in 500 shares of £1. Objects: to carry on the business of proprietors, designers, builders and manufacturers of and dealers in aircraft of all kinds. The directors are Ronald J. Falk, Francis B. Worman, and Frank A. Nichols. Registered office: 10, Old Jewry, London, W.C.2.

ERNEST V. COLE AND PARTNERS LTD.—Private company, registered July 6. Captial, £5,000 in 10,000 shares of 10s. Objects: to carry on the business of importers of and dealers in lubricants, motor spirits, oil fuels, etc., manufacturers of and dealers in aircraft and aerodrome equipment, etc. Christine H. Cole is the first director. Solicitors: Henry Pomeroy and Son, 44, Baldwin Street, Bristol.

LANCEGAYE SAFETY GLASS (IRELAND) LIMITED was registered in Dublin as a public company on July 2, with a nominal capital of £48,000 in 5s. shares. Objects: to carry on the business of manufacturers of and dealers in toughened, reinforced and non-splinterable glass, etc. The directors are: Harry Carlyle, Diarmuid A. MacManus, Cecil Wyndham Rea, Noel Mary Purcell, Patrick Cullen, Joseph McGrath.

THE CIVIL SERVICE FLYING ASSOCIATION LIMITED was registered as a private company on July 2 with a nominal capital of £10 in 10 shares of £1. The objects are to provide instruction and tuition in the art and science of aeronautics; to hire and let on hire aircraft of all types, and repair, sell and purchase aircraft, etc. The permanent directors are: Elwyn L. Black, Percival J. Collins, Elizabeth P. Jessup, Charles B. Turner, Henry V. Williams. The registered office is at 138, Green Lane, Edgware.

AERONAUTICAL PATENT SPECIFICATIONS

(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

(*Published July* 15, 1937.)

25502. NASH, A. F.: Turret or cupola mountings for guns and other instruments in aircraft, particularly aeroplanes, and other vehicles (467,485).

25579. FAUDI, F. (Trading as FAUDI, F. [Firm of]): Undercarriages for aircraft (467,486).

25798. DELL, C., and READ, H. L.: Variable-pitch airscrews and the like (467,488).

31340. TRZECIESKI, A.: Protective devices for the fuel tanks of vehicles, aircraft, and the like (467,334).

34513. DOWTY, G. H.: Undercarriages for aircraft (467,415).

34758. BELAIEFF, J. F. DELANEY, C. T., and GALLAY, LTD.: Cooler for oil and other liquids (467,420).

34829. PERCIVAL, E. W.: Aeroplanes and particularly the mounting of tail wheels or tail skids thereon (467,424).

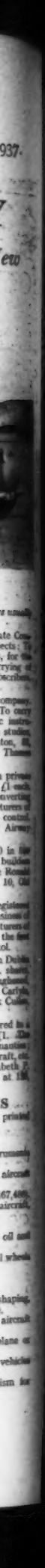
35196. MCGILL, H.: Variable-speed gearing (467,586).

35248. COATS, A. F. and HAFNER, R.: Rotary-wing aircraft (467,589).

12190. DOUGLAS AIRCRAFT CO., Inc.: Methods of an apparatus for shaping, forming and/or cutting sheet material such as sheet metal (467,365).

18368. MICHAELIS, Dr. K.: Construction of wing or controlling surface for aircraft (467,302).

19208. TAYLOR, G. I.: Hawse-piece for a ship, yacht, flying-boat, seaplane or other vessel (467,303.)

25320. FAUDI, F.: Joint for control rods in particular for aircraft, motor vehicles and the like (467,539).

31602. FAIREY AVIATION CO., LTD., and YOUNGMAN, R. T.: Mechanism for actuating the control surfaces of aircraft (467,465).